THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

[REGISTERED AS A NEWSPAPER.]

VOL. XXIX. No. 725.] LONDON, APRIL 3, 1877. [29TH YEAR.] Price 6d.

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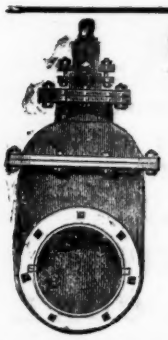

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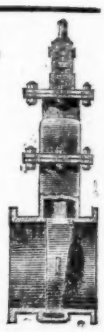

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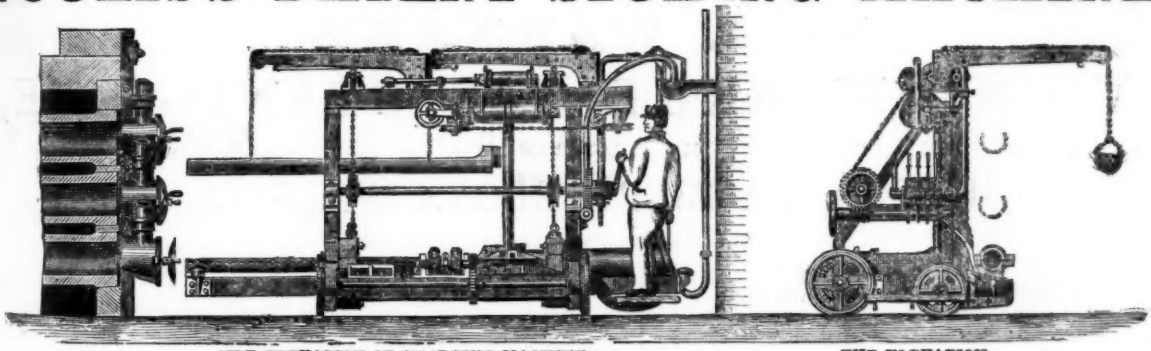

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The apparatus consists of a vertical pipe, the lower end of which is fixed to the main or collar, and the upper end to a box like a common syphon-box. Into this box is fastened a plate having a plug or valve thereon. The valve or barrel is fitted to a fixed seat or plug capable of turning upon it, and is square on the outside, and of such size as to fit a collar made to slip over it, the joint between the collar and the plug being made gas-tight by the former being forced down upon an india-rubber washer, by certain projections coming in contact with other projections formed in the interior of a cap or cover which surrounds the valve and collar before described. The top of the cover has a round hole with a notch or key-way on its opposite sides to admit of the projections or feathers on the collar passing through and on to the plug. To the collar is fixed the stand or service pipe, which is provided with an ordinary stopcock and gas-burner or pressure-gauge at its upper end. The action of the apparatus is simple. When it is desired to make the attachment, a service or stand pipe furnished with a collar, as described, is thrust down through the cap or cover, and, on being turned, will fix or jam itself tightly, so as to remain firmly upright, and at the same time turn on the gas from the main beneath. The action of removing the pipe effectually shuts off the gas, thereby ensuring great security against fraud, and loss by leakage.

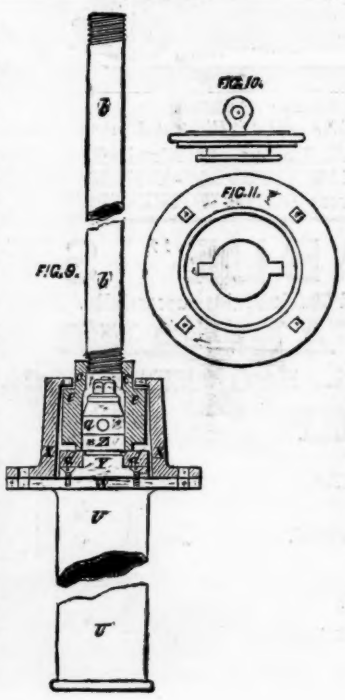

Fig. 9 represents the arrangement for the attachment of removable market or other gas stand-pipes. The view is a side elevation and part section. To the top of the service, U, is fixed a plate, W, and upon that is fastened by bolts the case or box, X. To the plate, W, is also fixed, by screws, the plug or valve, Y, and upon this plug the barrel Z is free to turn. That part of the barrel marked *a* is square. The stand-pipe, *b*, has attached to its lower end the collar, *c*, which is square in the interior, so as to slip over and turn the barrel by the square part, *a*, until the hole in the plug and that in the barrel coincide, when a gas-way will be established between the service, U, and the stand-pipe, *b*. A gas-tight joint between the collar, *c*, and the plate of the plug or valve, Y, is made by the former being forced down upon an india-rubber washer, *d*, by the upper part of the feathers, *e*, of the collar, *c*, coming in contact with inclined projections cast on the inner side of the box, X.

Fig. 10 is a plan of the top of the box or case containing the valve.

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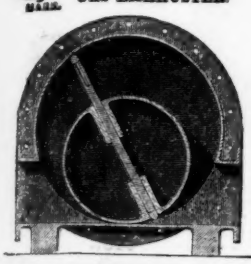

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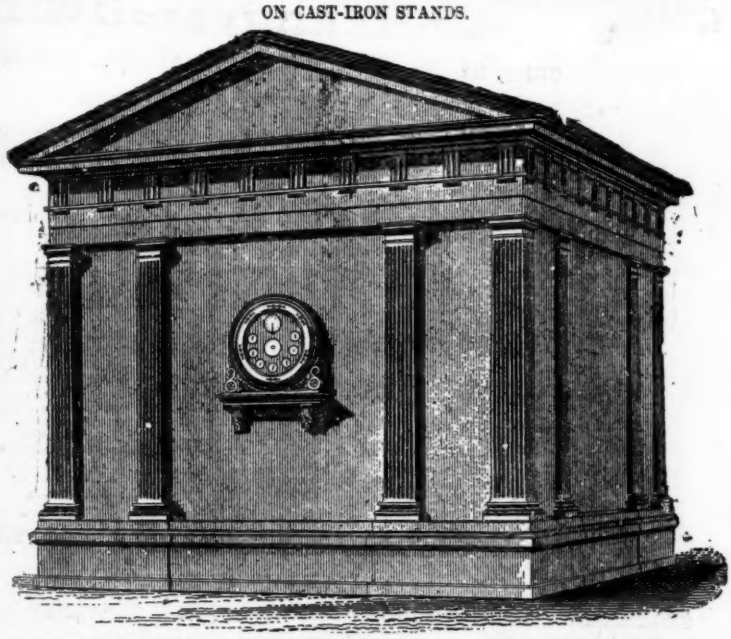

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FILES OF BEST QUALITY
FOR ENGINEERS,
STEEL OF ALL DESCRIPTIONS,
SCREW STOCKS, TAPS, AND DIES, SPANNERS,
RATCHET BRACES, LIFTING-JACKS,
ANVILS, VICES,
AND ENGINEERS TOOLS GENERALLY.
LONDON WAREHOUSE:
35, QUEEN STREET, CANNON STREET, E.C.

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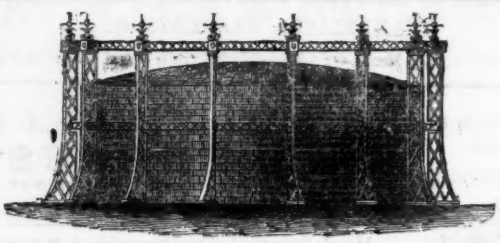
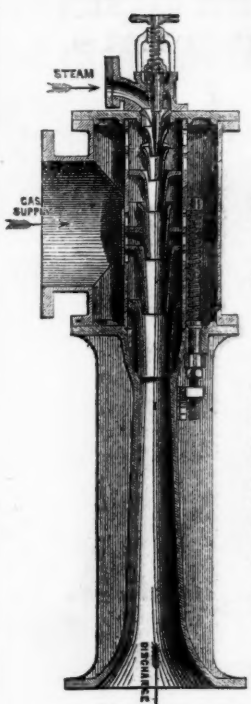
PHŒNIX FIRE-BRICK WHARF,
64, BANKSIDE, SOUTHWARK, LONDON, S.E.
GAS ENGINEER AND CONTRACTOR FOR THE ERECTION OF GAS-WORKS,
AND FOR THE
SUPPLY OF RETORTS, FIRE-BRICKS, CAST-IRON MAINS,
AND ALL MATERIALS FOR GAS MANUFACTURE AND DISTRIBUTION.



THE HORSELEY COMPANY,
LIMITED,
TIPTON, STAFFORDSHIRE.
LONDON OFFICE:
6, WESTMINSTER CHAMBERS, VICTORIA STREET,
GAS ENGINEERS, IRONFOUNDERS, &c.,
MANUFACTURERS OF
GASHOLDERS, WROUGHT AND CAST IRON TANKS, CONDENSERS, PURIFIERS, SCRUBBERS, MAINS, RETORT-LIDS, PLAIN AND DISHED, LAMP-POSTS, PIPES,
AND ALL REQUISITES FOR EITHER
GAS OR WATER WORKS;
ALSO
MAKERS OF ROOFS, BRIDGES, &c.

KÖRTING BROS.,
Steam-Jet Engineers,
7 and 17, LANCASTER AVENUE,
MANCHESTER,
AND 40, LOWER GARDINER STREET, DUBLIN.



E. KÖRTING'S PATENT
STEAM-JET GAS-EXHAUSTER.
IMPROVED CLELAND'S PATENT.
Small Cost—Compactness—Perfectly Self-Acting—Self-Regulating—Self-Cleansing—No Steam-Engine—No Attention—No Extra Room Required—No Wear and Tear—No Noise—No Oscillation in Vacuum, or Back Pressure.
UPWARDS OF 200 IN USE.
SUPPLIED TO—

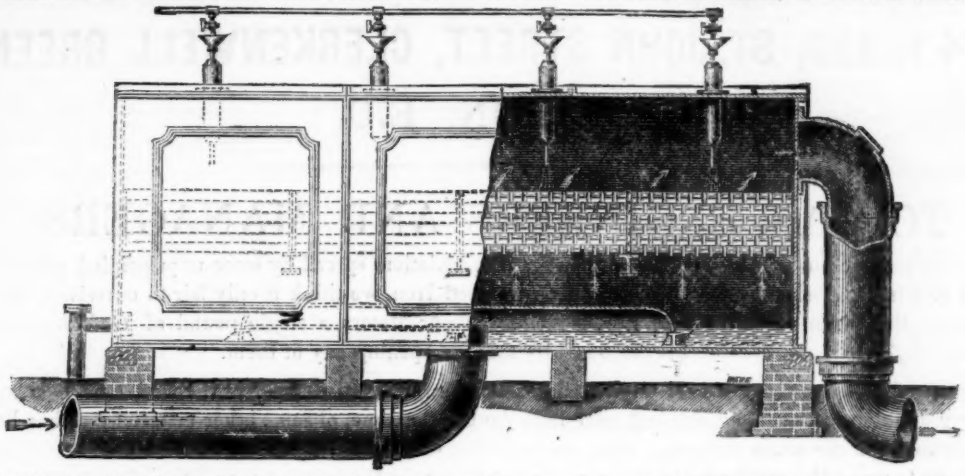
Chartered Gas Co.	Glasgow Corporation.	Hanna, Donald, and Wilson, London.
London Gas Co.	Leyland Gas Co.	Ratcliff Gas-Works.
S. Metropolitan Gas Co.	Stalybridge Gas-Works.	Kendal Gas-Works.
Phœnix Gas Co.	Lincoln Gas-Works.	Longton Gas Co.
Liverpool Gas Co.	Birmingham Gas-Works.	Dartford Gas Co.
Bolton Corporation.	Wakefield Gas-Works.	Exeter Gas Co.
Horsham Gas Co.	Brentford Gas-Works.	Harrogate Gas Co.
Epsom and Ewell Gas Co.	Burnley Gas-Works.	Hertford Gas Co.
Ipswich Gas Co.	Guildford Gas-Works.	Waterside Gas-Works, Todmorden.
Cheltenham Gas Co.	Gloucester Gas-Works.	F. W. Grafton and Co., Accrington.
Sandwich Gas Co.	Kirkintilloch Gas-Wks.	
Cornholme Dis. Gas-Wks.	Nantwich Gas-Works.	
Bury Gas-Works.	Enniskillen Gas-Works.	
	&c., &c., &c.	

E. KÖRTING'S PATENT STEAM-JET REVIVIFYING BLOWERS FOR THE PURIFYING MATERIAL.
SOLE LICENSEES FOR
W. CLELAND'S PATENT STEAM SCRUBBER AND SLOW-SPEED CONDENSER.
FOR PARTICULARS, APPLY TO
KÖRTING BROS., 7 and 17, Lancaster Avenue, MANCHESTER,
and 40, Lower Gardiner Street, Dublin,
OR TO
GERALD J. TUPP, 8, John Street, Adelphi, W.C., LONDON,
SOLE AGENT FOR ENGLAND AND WALES.

GAS PURIFICATION.

SAVILLE'S SELF-DISTRIBUTING GAS SCRUBBER-WASHER.

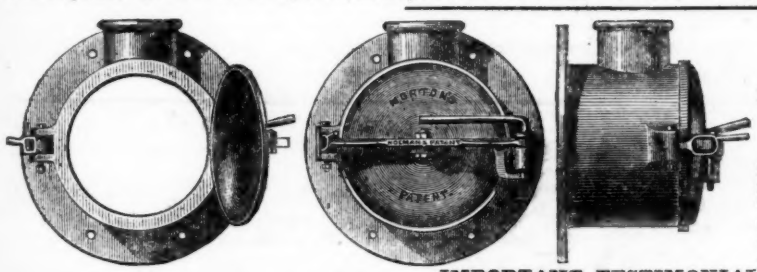
PATENTED IN GREAT BRITAIN, FRANCE, BELGIUM, PRUSSIA, AUSTRIA, & UNITED STATES.



MECHANICAL ARRANGEMENT.—The Washer Tank contains a large bottom chamber, into which the Gas is freely admitted through an ordinary full-way inlet-pipe, passing first under an inverted vessel which removes any Tar remaining in the Gas after leaving the Condenser; it then rises slowly over the whole surface, CONTAINING AN AREA OF ABOUT EIGHT TIMES THAT OF THE INLET-PIPE, through equidistant spaces in a series of Self-Sealing Water Troughs, arranged in tiers, dividing itself and passing through the various dips until it reaches the upper chamber, and from thence through the outlet-main. The washing liquid being CLEAN WATER is admitted by the Syphon inlets on top of Tank to the upper row of troughs, running through each successive tier, and becoming impregnated with the impurities extracted from the Gas, gaining strength at each dip on its descent, and finally passing off by the outlet syphon at the bottom. It will be observed that in this Scrubber-Washer the Gas comes first in contact with THE STRONGEST LIQUOR at the bottom, and passes through WEAKER LIQUOR at each successive tier, until it issues through CLEAN WATER into the upper chamber; hence the true principle of Gas Purification by Washing is simply and automatically effected.

ADVANTAGES.—Great economy in first cost and foundations; great saving of other purifying apparatus and material; occupies little space, and stands only a few feet in height; being entirely self-acting, requires no motive power either for purifying or distributing; the Gas is washed several times in ONE vessel, each time in liquor of a different strength, ultimately passing through CLEAN WATER; produces liquor of any required strength by once passing through; can be fixed (if desired) at any elevation to permit Contractors' tanks being filled without the expense of pumping.

One of these Scrubber-Washers has been in successful operation for the past twelve months at the Sowerby Bridge Gas-Works, and they are now being erected at the Corporation Gas-Works, Adderley Street, Birmingham, and at the Phœnix Gas-Works, Vauxhall, London.



MORTON'S PATENT SELF-SEALING RETORT-LIDS,

WITH

HOLMAN'S NEW PATENT BRACKETED CROSS-BARS, ANTI-FRICTION CATCHES AND ECCENTRIC FASTENINGS.

Instantaneous Sealing effected. No Luting. No Duplicate Lids required. Holman's New Self-Sustaining Cross-Bar ensures freedom of joint and maintains parallel position of the Lids.

Since their introduction in 1869, these Patent Retort-Lids have been thoroughly tested (rigid cast iron is now successfully employed), nearly 25,000 being in use at various Gas-Works in London and the Provinces.

IMPORTANT TESTIMONIAL.

The Gaslight and Coke Company (commonly called the Chartered Gas Company), Beckton, North Woolwich, July 2, 1874.

MESSRS. TANGYE BROTHERS AND HOLMAN.

Gentlemen,—In answer to your inquiry respecting the Self-Sealing Lids, I beg to say that they continue to work well, and I have every reason to be satisfied with them. I should be very sorry to return to the old system of Luting, and our stokers here freely acknowledge the benefit to them of the new system.

I am, yours truly, (Signed) G. C. TREWBY.

HUNT'S PATENT EQUILIBRIUM GAS-GOVERNOR.

In this Governor a Throttle-Valve is substituted for the ordinary suspended Cone, all external communications being avoided by placing the Lever or Radius Arm (shown in the drawing) inside the Valve-Chamber upon the Disc. The Disc is carried upon steel centres, upon which it is accurately balanced and turns freely. The friction in working is thereby reduced to a minimum. This Governor is extremely sensitive to alterations of inlet or outlet pressure, and renders a large actuating holder unnecessary.

The principal advantages of this arrangement over the ordinary form of Governor are as follows:—

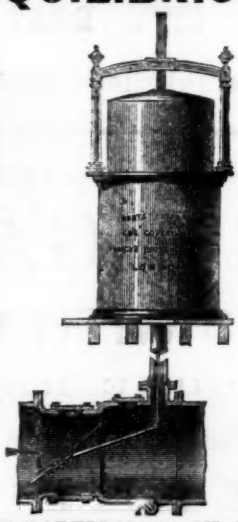
Its sensitive action prevents oscillation.

It is self-adjusting—*i.e.*, it maintains a steady pressure under variations of inlet pressure or a fluctuating consumption.

The inlet to Gasholder being contracted to the smallest possible dimensions, all danger from leakage through insufficiency of seal, tilting, &c., is entirely avoided.

The valve portion being separate from the holder, it can be handled and fixed like an ordinary Slide-Valve direct in the main; and the holder can be placed at any convenient distance immediately above it. The cost is thus materially reduced, and the inconvenience of heavy lifts done away with.

There are no working parts likely to get out of order.



These Governors have been adopted by many leading Gas Companies, among whom are the following:—

The Gaslight and Coke Co. (9), The London Gas Co. (3), and at Abergavenny, Birmingham, Cannes (France), Devonport, Dronfield, Dursley, Exeter, Guernsey, Mentone (France), Monmouth, Newcastle-on-Tyne, Oxford, Plymouth, Rochdale, &c.

TESTIMONIAL.

The Gaslight and Coke Company,
9, Water Street, New Bridge Street,
Blackfriars, E.C., Feb. 27, 1875

MESSRS. TANGYE BROTHERS AND HOLMAN.

Gentlemen,—The two 24-inch and three 36-inch Hunt's Equilibrium Governors supplied by you, and fixed in the valve-rooms at Whitechapel, Goswell Road, and Blackfriars, are working very satisfactorily.

Yours truly,

(Signed) JOHN JOHNSON.

PRICES AND FULL PARTICULARS ON APPLICATION TO

TANGYE BROTHERS & HOLMAN,

SOLE MANUFACTURERS,

LAURENCE POUNTNEY LANE, LONDON, E.C.

THOMAS GLOVER & CO.,

DRY GAS-METER MANUFACTURERS,

214 TO 222, ST. JOHN STREET, CLERKENWELL GREEN,

LONDON, E.C.

TO GAS ENGINEERS AND MANAGERS.

It having come to our knowledge that a report is in circulation, spread by some unprincipled person or persons, that the cases of our larger-sized Meters are made of Galvanized Iron, we think it only fair to ourselves, and just to our customers, to say, that we never have used, in making any of our Meters, a single pound of *Galvanized Iron*, or any other *cheap* and *inferior material*, and this can be easily seen by opening any of them.

The cases of our large-sized Meters, from 20 lights and upwards, are all made of the very *Best Best Patent Alloy*, which is nearly double the price, and will last more than double the time, of some other material that has been and still is very largely used for the same purpose. And our experience, acquired by an extensive use of it for upwards of 30 years, enables us to say with confidence that no other metal in use for the purpose is so little liable to corrosion from the action of the gas.

We have now in use a Meter made in 1848, and therefore 29 years old, the case of which is made of Patent Alloy; the Meter is still in perfect order, and shows no signs of decay.

The utmost care is exercised by us in selecting none but the very best materials for all parts of our Meters; much of it is made *expressly for us*, as it is not possible to obtain it in the open market of the same superior quality.

The great fall in the price of all materials used in making our Meters has enabled us to give an increased discount, thus giving our customers the benefit of the fall. This we were bound in fairness to do, as we raised the price of our Meters four years ago, when the price of all metals went up.

It will be our constant endeavour, by using none but the best materials, and employing the most skilful workmen, to maintain the high character our Meter has hitherto borne.

WILLIAM PARKINSON & CO.,

(SUCCESSORS TO SAMUEL CROSLEY,)

COTTAGE LANE, CITY ROAD, LONDON, E.C.

Established 1816.

MANUFACTURERS OF PATENT

WET & DRY GAS-METERS,

STATION-METERS WITH PLANED JOINTS,

GOVERNORS, PRESSURE REGISTERS, GAUGES,

AND EXPERIMENTAL APPARATUS,

STREET-LAMP METERS,

AND REGULATORS FOR AVERAGE METER INDICATION.

METERS FOR MEASURING WATER.

CONTENTS.

Circular to Gas Companies:— PAGE
The Proposed New Standing Order . . . 489
Return ordered by House of Commons under the Companies Act, 1862 . . . 489
The Sulphur Question in the Metropolis . . . 489
Defeat of the Ramsgate Local Board Bill . . . 489
Sale of the Blackburn Gas Company . . . 490
Gas Agitation at Exeter . . . 490
Opposition to the Bill of the Leicester Gas Company . . . 490
The Commercial Gas Company's Accounts . . . 490
The Surrey Consumers Gas Company's Accounts . . . 490

Water and Sanitary Notes:—
The Causes of the Spread of Rinderpest . . . 490
The Accounts of the Metropolis Water Companies . . . 490
Politics in the Sheffield Town Council . . . 490
A Charge against the Water Engineer of Liverpool . . . 490

Communicated Article:—
Contributions to the Theory of Luminous Flames. By Dr. Karl Heumann . . . 491

Correspondence:—
Auction Clauses in Gas Bills . . . 492
The Construction of Gas-Globes . . . 492

Parliamentary Intelligence:—
Progress of Bills in House of Lords . . . 493
Progress of Bills in House of Commons . . . 493
House of Commons Committee—
Ramsgate Local Board Bill . . . 493

Legal Intelligence:
Yorkshire West Riding Spring Assizes—Regina v. the Colne Valley Gas Company 498

Miscellaneous News:—
North Camp and Farnborough District Gas Company . . . 491
Weston-super-Mare Water-Works Company . . . 491
Clithero Water-Works Company . . . 493
Crookes's Force . . . 493
Quality of the Newcastle-on-Tyne Gas . . . 499
Accounts of the Metropolitan Water Companies for the Year 1875–6 . . . 500
Extension of the Wishaw Gas-Works . . . 500
Meeting of the Crystal Palace District Gas Company . . . 501
Metropolis Gas Supply . . . 501
Metropolis Water Supply . . . 501
East London Water-Works Company . . . 502
Tunbridge Wells Water Supply . . . 502
The Chemistry of Gas Manufacture. By A. Vernon Harcourt, Esq., F.R.S. . . . 502
Iron and Steel Institute . . . 504
The Economical Consumption of Gas . . . 505
Gas Affairs in America . . . 506
Trade Reports . . . 507
Gas Apparatus Exhibition . . . 508
Death of Mr. C. E. Cawley, M.P. . . . 508
Scarborough Water Company . . . 508
Reductions in the Price of Gas . . . 508
Sale of Provincial Gas Shares . . . 508
Stockton and Middlesbrough Corporation Water-Works Purchase . . . 508

Register of New Patents:—
Applications for Letters Patent . . . 508
Patents which have passed the Great Seal . . . 509
Patents which have become void . . . 509
Share List of Metropolitan Gas and Water Companies . . . 509

TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

MANAGER OF A SMALL COUNTRY WORKS.—*You will waste all your ammonia without effecting any beneficial result by slaking your purifying lime with weak ammoniacal liquor instead of water.*

THE JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, APRIL 3, 1877.

Circular to Gas Companies.

MR. RAIKES did not, last Monday week, move the adoption of the additional Standing Order, the object of which is to compel the sale of all new gas shares by public auction. Our "Parliamentary Intelligence" shows that the consideration of the matter has been deferred until Friday, April 6. In the meantime, as will be seen by an able letter from Mr. W. Livesey, printed in another column, the Association of Gas and Water Companies have become alive to the gravity of the question. Mr. Raikes, it seems, has been prompted by that strangely misnamed body, the Board of Trade. We are well aware that some of the permanent officials of this remarkable institution have a sort of craze respecting auction clauses. They would, if they could, include in their operation all sorts of Joint-Stock Companies; but Gas and Water Companies are the most accessible game. We have repeatedly urged that the right of existing shareholders to allotments of new shares at par, when original shares are at a premium, has been established by the Legislature, and we cannot see why the privilege should be abolished at the bidding of the officials of a Government department.

We have to call the attention of our readers to a return ordered by the House of Commons, on the motion of Mr. Chadwick, on the 27th ultimo, which, we fear, is of importance to very many Gas Companies. The order is for a list, "alphabetically arranged, of all Joint-Stock Companies which have at any time during the last seven years ending on the 31st day of December, 1875, failed to make the annual return required by the 26th section of the Companies Act, 1862, showing how often each Company has so failed during those seven years."

The section of the Companies Act referred to is as follows:—

> Every company under this Act, and having a capital divided into shares, shall make once at least in every year a list of all persons who, on the fourteenth day succeeding the day on which the ordinary general meeting, or if there is more than one ordinary meeting in each year, the first of such ordinary general meetings, is held, are members of the company; and such list shall state the names, addresses, and occupations of all the members therein mentioned and the number of shares held by each of them, and shall contain a summary specifying the following particulars:—
>
> (1.) The amount of the capital of the company, and the number of shares into which it is divided:
> (2.) The number of shares taken from the commencement of the company up to the date of the summary:
> (3.) The amount of calls made on each share:
> (4.) The total amount of calls received:
> (5.) The total amount of calls unpaid:
> (6.) The total amount of shares forfeited:
> (7.) The names, addresses, and occupations of the persons who have ceased to be members since the last list was made, and the number of shares held by each of them.
>
> The above list and summary shall be contained in a separate part of the register, and shall be completed within seven days after such fourteenth day as is mentioned in this section, and a copy shall forthwith be forwarded to the Registrar of Joint-Stock Companies.

What Mr. Chadwick intends to propose when he learns what Companies have not complied with the law we do not know.

The great sulphur battle has still to come off, and the issue is, of course, uncertain. In the meantime, some important correspondence between the Board of Trade and the Metropolitan Gas Referees, on the Sulphur Question has been published, which we hope to lay before our readers *in extenso* next week. It is sufficient to say now that the present Referees do not retreat from the position taken up by their predecessors. To have done so would have been virtually to confess their inability to fulfil the functions imposed on them by the Metropolitan Gas Acts since 1868. This, naturally, they are not disposed to do, and we must confess to some sympathy with them in their difficulties. With, however, a parliamentary inquiry of great importance impending, we hesitate to enter upon a discussion of the serious questions raised in the correspondence to which we have alluded. Our readers will, we hope, see it for themselves next week, and they will form their own judgment. Broadly speaking, the question raised by the Bill of the Chartered Company is, "Referees or no Referees," for matters in connexion with the sulphur question are all that they have to decide. The tests for illuminating power and the arrangements of the testing-stations have now been settled. The ammonia question, we might almost say, has settled itself, and if a Parliamentary Committee affirm that, with our present knowledge of the methods of purifying gas, it is impossible, with fairness to the Gas Companies, to fix a sulphur maximum, it will be unjust to leave the Companies saddled with the expense of officers who are no longer of any use. It must be understood that we here express no opinion on the matter, which is of too much consequence to be disposed of without mature consideration.

It is, perhaps, impossible to overrate the importance of the decision of the Commons Committee on the Ramsgate Bills. It will give a check to the filibustering propensities of Local Authorities, which were stimulated by the decision in the Middlesbrough case last session. Efforts at confiscation, it will be seen, are not always successful; and local authorities, if they are wise, will think twice before they incur heavy expenses in a doubtful parliamentary contest. The ratepayers of Ramsgate will presently wince at the rate which must inevitably be imposed upon them to defray the costs inflicted by a narrow majority, beguiled by promises which in no case could have been fulfilled. We may pity the Rev. E. G. Banks's dupes, while rejoicing over his defeat. What alterations may be made in the Bills of the Companies when the clauses come before the consideration of the Committee next week we, of course, do not know; but we do hope the Companies will not relinquish their claim to capitalize expended profits. The right to do this has been firmly established by parliamentary precedent—we say nothing of the moral right—and the only question hitherto has been the rate of interest to which "Improvement Stock," as it is called in the Ramsgate Bills, shall be entitled. This, it appears to us, will be the point for the Companies and their advisers to consider; and when we see who the advisers are, we feel certain that as much consideration will be given to the public as to the private interests of the shareholders. Mr. Banks affects a pity for the "poor shareholders," whose pockets he professes to think will suffer from this year's legislation so much that they will soon force the Directors to sell their undertaking. We think that the Companies will continue to prosper, and that the shareholders will repose perfect confidence in the directorate, which is more, we strongly suspect, than the ratepayers will do in the

members of the Local Board. To get votes in support of the prosecution of their Bill, the Board promised an immediate reduction of 10d. in the rates. The result, however, is that an additional shilling at least, if not more, will be necessary this year. When the provisions of the Companies Bills have been definitely arranged, we shall have more to say on the general principles involved, as well as the circumstances peculiar to these cases.

With regard to the case of the Blackburn Gas Company, reported in our last, we have a fear that some people will imagine that a compulsory purchase has been effected by the Corporation. We can assure them that nothing of the sort has taken place, though, no doubt, Sir Edmund Beckett will, next session, declare that it has been made. The Company have agreed with the Corporation to sell the undertaking on their own terms. It is one of the best managed in the kingdom, as will be seen when we publish a working statement, for which we have not space this week. We only now allude to the terms of transfer, to remove an impression that may have been upon some minds, that a compulsory purchase has been effected. Nothing of the sort has taken place. The Company, the shareholders in which, we believe, are interested in the borough and neighbourhood, have elected to sell—that is all.

The Exeter Town Council, in accordance with advice given, are about to make an attempt to purchase, by agreement, the undertaking of the Exeter Gas Company, who, also acting under advice, will, we presume, decline to sell. Thus there is a prospect of another parliamentary contest next year, which will, in some of its features, resemble the Ramsgate case recently decided. The agitation at Exeter is kept alive by continual accusations of a nuisance from the works, the cause of which no one seems to be able to satisfactorily explain. An allegation of nuisance cannot, however, be accepted as sufficient reason for the confiscation of a Gas Company. If the occasional escape of vapours from a gas-work, which some people may deem unpleasant, be a valid excuse for confiscating an undertaking, we know of no Company who can be considered safe. Nor, indeed, do we know of any Corporation works against which complaints might not occasionally be made. We fear that this must be regarded as a "squeamish" age. But gas smells are not the only offenders. Medical works tell us that the odour of violets has produced epileptic attacks; the smell of musk, we have been personally assured, has occasioned violent fits of hysterics. What wonder, then, that the smell of tar and liquor should, in some subjects, induce disagreeable symptoms.

The Leicester Gas Company, as our readers know, are promoting a Bill in Parliament, one object of which is to acquire land on which to erect new works. The site they have chosen is admitted to be the best the neighbourhood affords; but, unfortunately, a portion of the land selected is part of the "Freemen's Estate," and the "Freemen" vehemently protest against the erection of gas-works thereon, and are about to petition Parliament against the Company's Bill. We may confess that we do not know sufficient of the locality to enable us to form any opinion as to the prospective value of the land which the Company have selected; but we must protest against the notion that the existence of gas-works invariably depreciates the value of property in their neighbourhood. Then, again, a danger to health is asserted, when it is a well-known fact that the locality surrounding a gas-work is always, *cæteris paribus*, exceptionally healthy. Gas-works may be admitted to be unsightly, and then you have said the worst of them.

We have received the report of the Directors, and the accounts for the past half year, of the Commercial Gas Company. It need hardly be said that, with gas at 3s. 9d., the Company have realized a large profit on the half year's working. Large as it is, however, it falls some £2000 short of the sum required to pay full dividends; but there is an unappropriated balance much more than enough to meet the deficiency. The reason the profit is not greater is to be found in the fact, that the Directors have erected "exceptional and abnormal" purifying plant, the cost of which they have defrayed out of revenue, while the greater part might have been fairly charged to capital. The result is that the East-enders will not get that reduction of price they so earnestly desire.

We do not like verbal criticism, but we feel bound to call attention to the use of the word "abnormal." We do not believe that the works are "abnormal." We have no doubt that they have been excellently planned and well constructed, and are eminently calculated to effect their purpose, when they are used with skill. But, supposing the works to be really "abnormal," who but the Directors are to blame? And why should the consumers—for it comes to that—be made to pay for "abnormal" works, which certainly cannot be required in any gas undertaking?

The Surrey Consumers Company, with gas of not less than twelve-candle power, at 4s. per 1000 cubic feet, have necessarily done better. They can pay full dividends, and then, after paying interest on bonds, will have £2446 to carry to a balance of an already respectable amount. We hope that the Directors may soon find it possible to make some reduction in the price of gas, and relinquish their pre-eminence as the highest-priced Metropolitan Gas Company.

Water and Sanitary Notes.

WHATEVER sentimentalists may say to the contrary, it cannot be denied, we believe, that the most important information we have obtained with regard to the physiology of the human being has been derived from experiments made on the lower animals. It is not, however, our purpose now to defend the practice of vivisection. We only wish to point out the opportunities that the presence of Rinderpest in the Metropolis offers for a study of the mode in which contagious diseases are propagated. The disease makes a sudden leap from Whitechapel to Shepherd's Bush. There is a suggestion that the contagion may have been carried from the cattle-shed at the East to that in the West, by an individual who goes about inoculating for pleuro-pneumonia; but, so far as we have seen, the man's wanderings have not been traced.

Cholera, also, has made extraordinary leaps, no satisfactory explanation of which has ever been offered. Animals, however, and particularly cows confined in dairymen's sheds, afford special advantages for a study of the means by which contagion is spread. They never go out to meet the virus; it must be brought to them. We hope, then, that the origin of every outbreak will be diligently investigated. There seems to be no suspicion in this case, that water has anything to do with the extension of the disease, which, considering the fertility of the imagination of the enemies of the Water Companies, appears to us very remarkable. It may, perhaps, be accounted for by the fact, that veterinary surgeons are men of common sense, wedded to the old-world theory, that personal contact is the one essential to the spread of contagious disease, and not given to dogmatizing on matters respecting which they possess but limited information. We look, therefore, to the Veterinary Department of the Privy Council for a most careful investigation into the origin of every outbreak of cattle plague, certain that it will throw valuable light on the causes of the spread of all epidemic diseases.

We publish to-day our abstract of the accounts of the Metropolitan Water Companies for the year 1875-6. At present we have no space for comment on some interesting features revealed, but may, perhaps, call attention to them next week.

The woes of the Town-Clerk of Sheffield have greatly excited a portion of the population, and much dirt is being thrown in all directions. Nobody, however, appears to offer to pay the money the Clerk is out of pocket. On one side it is attempted to be shown that the Councillors, who in Sheffield resolved to withdraw the Water Bill of the Corporation, ought to be made responsible. Counsel in London, it is said, were certain of success; but we believe that the Councillors in Sheffield were much better informed, and knew that the Bill had not a ghost of a chance, and that they saved the Town-Clerk a good deal of money by not prolonging an inquiry which could have had but one end. We have often regretted the introduction of party politics into municipal affairs. Sheffield is a shocking example, and we notice that all the blame is thrown upon the "Liberal" party in the Council. Some in Sheffield affect to consider that the profession of Free Trade principles is inconsistent with the holding of shares in what is denominated a "monopolist" Water Company!!

We have not hitherto noticed an inquiry which has proceeded for some weeks before the Water Committee of the Corporation of Liverpool, in relation to an accusation brought by Mr. Alderman Bennet against Mr. Deacon, the water engineer, that he had appropriated or plagiarized some plans sent to the Water Committee by Messrs. Mather and Platt. When two gentlemen have to prepare plans for works to be erected on the same spot, for a common object, it is hardly possible that the designs should not have some features in common. The Water Committee, after a full investigation, have completely exonerated Mr. Deacon from the charges brought against him. His reputation in his profession is too high to need any defence from us; but we may express an opinion that he is perfectly incapable of appropriating another man's ideas in the way alleged.

Communicated Article.

CONTRIBUTIONS TO THE THEORY OF LUMINOUS FLAMES.

By Dr. KARL HEUMANN.

[Translated from the *Journal für Gasbeleuchtung.*]

PART I.

(*Continued from page* 14.)

In order to prove that the same phenomena will occur in luminiferous vapours, provided they are not oxidized into a feebly luminous gas by an excess of oxygen, hydrogen was passed through a vessel containing common salt and zinc turnings, on which dilute hydrochloric acid was poured. The gas issued from a fine luting-tube, and burnt with an intense yellow light, owing to the particles of salt carried along with it. When this flame was passed into a vessel containing pure oxygen, no disillumination ensued, but, on the contrary, a far more brilliant light was emitted.

If, therefore, the disillumination of a narrow gas-flame in pure oxygen is a result of the admission of an excess of this latter gas, while disillumination does not take place so conspicuously in atmospheric air, it is because of the presence of the inert nitrogen which dilutes the oxygen and diminishes its oxidizing energy.

To prove the correctness of this explanation, the nitrogen of the atmosphere was replaced by carbonic acid—that is to say, a glass cylinder was filled, over water, with one volume of oxygen and four volumes of carbonic acid, and after due mixture of the two gases a gas-flame issuing from the fine point of a brass tube was introduced.

The flame remained just as luminous as if it were burning in atmospheric air; from which it follows that the nature of the inert gas mixed is immaterial, and that the dilution of the oxygen alone regulates the result.

Every neutral gas must act in this way, and therefore the products of combustion of the flame itself will form no exception. If the flame is allowed to issue from a fine brass tube into a flask (with the neck downwards) filled with oxygen, and to burn there, at first the disillumination above described takes place, but presently, when the carbonic acid and aqueous vapours produced by the combustion have sufficiently diluted the oxygen, the flame will begin to regain its luminosity. The light cone that was reduced to a bright point gradually enlarges, and finally the flame, continually increasing in volume, exhibits the same appearance as if it were burning in air; this will occur at the moment when the oxygen remaining in the flask is diluted by the gases of combustion in exactly the same proportion in which, in the air, the oxygen is diluted by the nitrogen.

If the re-illuminated gas-flame continues to burn inside the flask, disillumination presently again takes place; but not, as at first, from the outside by excessive diminution of the luminiferous envelope, but by gradual reduction of the light until the flame is entirely disilluminated. The whole flame continues to increase in size, and is finally extinguished. This method of disillumination is quite similar to the disillumination of a flame by neutral gas, such as carbonic acid or nitrogen, being mixed with the gas burned, and, in fact, the cause of disillumination is identical in both cases. As every ordinary flame* requires two combustibles for its production, their chemical combination causing the gases to glow and emit light, it must be a matter of indifference *which* of the gases is diluted by neutral gas—whether the illuminating gas, as in Knapp's experiment, or the oxygen of the air.

And, in fact, a gas-flame, burning with a bright flame in the air, at once becomes blue if it be introduced into a mixture of five volumes of air and two volumes of carbonic acid contained in a larger vessel. This experiment is, to a certain degree, the reverse of Knapp's, yet it equally causes disillumination, as a consequence of dilution and reduction of the temperature of the flame.

Instead of mixing carbonic acid with the air before commencing the experiment, the mixture may be allowed to take place through the combustion of the flame itself, when it will be found that a luminous gas-flame burning in a flask filled with air, and with its mouth turned downwards, will, after a short time, become fainter, and finally quite blue, at the same time increasing considerably in size. The flame will continue in this non-luminous, almost invisible state, for some time (according to the size of the flask), and burn bright again immediately, if brought back into the open air in sufficient time, otherwise it will go out. This case of disillumination is, therefore, quite analogous to the second disillumination which takes place when a gas-flame burns in a closed reservoir of oxygen; only, in this latter case, there is no nitrogen present, and the products of the combustion of the flame alone dilute the oxygen.

When, therefore, a narrow luminous gas-flame is introduced into an atmosphere of oxygen, confined in a close vessel, we observe first—

Disillumination of the flame, during which the diminution of the luminiferous envelope takes place from the exterior inwards, and in favour of the faintly luminous surface which increases in size.

Then, after a short time, increased development of light takes place, till the flame recovers the shape and luminosity belonging to it in atmospheric air, because the energetic oxidizing power of the pure oxygen on the burning gas becomes moderated through dilution with the gases produced by combustion.

And lastly, in a short time after, disillumination again takes place, but this time chiefly through diminution of the illuminating power of the whole luminiferous envelope, occasioned by increasing dilution of the oxygen still present with the inert gases of combustion, combined with a lowering of the flame temperature. Both these agencies operate with increasing effect, till the flame, after becoming blue, then almost invisible, while still increasing in size, is at length cooled below the temperature necessary for combustion of the gas, and is finally extinguished.

From the above it results that disillumination may be produced, not only by refrigeration and dilution of a carbon-containing flame, but also by a third course—namely, *rapid decomposition of the luminous material—i.e.*, immediate oxidation of the carbon to a faintly luminous gas (carbonic oxide and carbonic acid).

If we recapitulate the means—as shown during this investigation—by which disilluminated flames may be restored to brilliancy, we arrive at these results:—

That hydrocarbon flames, deprived of their light by withdrawal of heat, are revived by an *increase of heat.*

That flames disilluminated by dilution with air or neutral gas, are restored by *raising the temperature of the flame.*

And that flames disilluminated by excess of oxygen causing a too rapid oxidation of the carbon, will recover their luminosity by *dilution of the oxygen with neutral gases.*

It would be interesting to know whether flames disilluminated by a mixture of neutral gas, besides being restored by heating the burner, would also become brilliant again if burned under such a pressure that the molecules of the combustible gas were, notwithstanding the admixture of nitrogen or carbonic acid, forced as closely together as they were originally. Unfortunately, I do not possess the apparatus necessary for such experiments, and I should like to draw the attention of those talented chemists, who have investigated the phenomena of combustion under increased pressure, to the action of various flames when disilluminated by admixture of air or neutral gas, or by refrigeration. It also remains to be proved whether the disillumination which a narrow gas-flame undergoes in pure oxygen ceases if the oxygen atmosphere is rarefied to one-fifth, or less, of its original density.

The essential difference which existed between the views of previous experimenters — namely, on the question as to whether refrigeration or dilution was the cause of the disillumination of carbon-containing flames, when air or neutral gas was mixed with the gas burned—seems to me to be now definitively settled, and the fact ascertained that, at least, *three* different causes may, any one of them, effect disillumination—namely, *refrigeration*, *dilution*, and *oxidation of the combustible material.*

In most cases two, or even all three of these causes will come into operation; thus, in disillumination by nitrogen or carbonic acid, dilution and refrigeration are chiefly concerned; in enlarging the flame by a cold body, refrigeration and the more rapid oxidation of the carbon come into play; while in disillumination by air, all three causes are combined; moreover, in this latter instance, the presence of the oxygen added occasions an increase of the flame temperature, and a diminution of the flame itself—effects quite opposed to the action of refrigeration and rarefaction.

From this reasoning it follows that the much-canvassed flame of the Bunsen burner is really the ultimate result of a whole series of forces acting, some in the same, some in opposite directions; and it is not surprising that views should differ so widely respecting the constitution of luminous flames, when this very flame of the Bunsen burner is usually selected as the most fitting example of disillumination, thus unconsciously choosing the most complicated instance, and the least fitted of any for introductory study.

* Except the flame of exploding materials.

NORTH CAMP AND FARNBOROUGH DISTRICT GAS COMPANY, LIMITED.—At a meeting of the directors of this company, held on the 28th ult., the tenders of Messrs. Willey and Co., of Exeter, were accepted for the iron apparatus, the cast-iron mains and the laying of the main-pipes; and of Mr. Robinson, of the Rockingham Works, New Kent Road, London, for the buildings, gasholder-tank, &c. The tenders accepted in each case were the lowest. The plans were prepared by Mr. Hedley, consulting engineer of the War Department Gas-Works, Aldershot Camp, and the quantities were supplied by Messrs. Franklin and Andrews, of Adelaide Place, London Bridge.

WESTON-SUPER-MARE WATER-WORKS COMPANY.—The annual meeting of this company was held on Saturday, March 24—the chairman, Mr. Alfred Hill, presiding. The report of the directors was as follows:—"The net earnings of the year, after deducting the interest on the mortgage debt, £178 3s. 6d., the £100 set aside to depreciation-fund, and £653 2s. paid as directors and auditors back fees, in accordance with the resolution of the meeting of shareholders held on May 20, 1876, amount to £1295 15s. 3d., and the balance to the credit of revenue account is £1444 4s. 7d. It will be in the recollection of the proprietors that, during the first ten years of its existence, the depressed state of the company's affairs precluded the payment of any dividend whatever, and it was not until the year 1864 that the first dividend was paid. This first dividend did not exceed 2½ per cent. From that date, however, the rate of dividend has progressively increased, until the increased profits in 1874 enabled the company to reach its maximum dividend of 7½ per cent. While by the Act of Incorporation the dividend is limited to 7½ per cent. for any one year, a power is reserved to the company to make up to the proprietors, out of surplus profits, the deficiency of dividends of the years in which less than 7½ per cent. was paid. In November last an interim dividend of 4 per cent. was paid on the original shares, and also an interim dividend of 3½ on the paid-up capital (£5) of the new shares of 1874. There remains, therefore, but 3½ per cent. on the former, and 4 per cent. on the latter, payable to the proprietors to make up the maximum dividend of 7½ per cent. for the year 1876. But the directors are happy to state that the affairs of the company now admit of its availing itself of the powers above referred to, and of paying out of surplus profits 1 per cent. towards making up the deficiencies in dividend in the years prior to 1874. It will be proposed, therefore, that the dividend to be now paid on the original shares shall be 4½ per cent. instead of 3½ per cent.; making, with the interim dividend already paid, a total of 8½ per cent." The report was adopted, and a dividend declared in accordance with the recommendation in the report. It was also resolved that an interim dividend of 4 per cent. for the half year on all the capital of the company be paid in November next.

Correspondence.

AUCTION CLAUSES IN GAS BILLS.

SIR,—In your paper of last week you state that the Chairman of Ways and Means had given notice to move in the House of Commons, on Monday, March 26, a new Standing Order, to the following effect:—"In every Bill by which an existing gas company is authorized to raise additional capital, provision shall be made for the offer of such capital by public auction or tender, at the best price which can be obtained." And you add that, "We write this with a conviction that, before these lines meet the reader's eye, the Standing Order will have been adopted; but, nevertheless, we think it right to put a protest upon paper." Fortunately, however, this was not the case, although it must be admitted that there was just ground for assuming that it would be so; for if it had been brought on at such a short notice, and in the manner proposed, under the auspices of the Chairman of Ways and Means, it would, no doubt, have been passed.

The notice of this motion appeared first in the Votes that were delivered to members on Thursday morning, the 22nd inst., when it merely said that it would be moved for "on an early day," which, as it was then within two or three sitting-days of the recess, all parties interested concluded would be some day after the recess. But in the Votes delivered to members on the following day—that is, Friday, the 23rd inst.—this "on an early day" was exchanged for "Monday, the 26th of March." There was thus no time to call the companies together and ascertain their views, so the solicitors and agents who have been accustomed to act for the provincial companies (without waiting for specific instructions) took the matter up in the interests of their respective clients, and having ascertained, with the kind assistance of some members, that the motion had been made at the instance of the Board of Trade, they formed a deputation, and, with the secretary of this Association, waited upon the Board.

The deputation stated that they did not attend the Board to discuss the merits of the proposal, but to point out the great injustice of pressing forward a motion of such importance, affecting property amounting probably to 100 millions of money, in such haste that the parties whose interests would be so largely affected by it could not, in the ordinary course of events, have any knowledge of what was being done, and so urge its being put off until after the recess.

The President of the Board thereupon said that he thought the request was but reasonable, and he would write to the Chairman of Ways and Means to that effect; and shortly after information was sent to the parties that the motion would be adjourned until Friday, the 6th of April.

In plain terms, this proposal is nothing more nor less than to provide, by a Standing Order, that no gas company shall in future be allowed to derive any benefit from the extension of their operations.

The object of the Standing Orders of the House of Commons, so far as the public are concerned, is simply to regulate the proceedings before the House. Adopting that view, the question forces itself upon the minds of all persons interested—Is it right to deal with such an important provision as this as a mere question of proceeding?

The principle involved is not confined to gas companies, it affects all commercial undertakings in the United Kingdom acting under parliamentary powers. If it is sanctioned, it will give to the House the power of overriding, by its own Standing Orders, every public Act that may be passed for the regulation of those companies; and it is obvious that there could be no limit to such a power, or to the injustice that might be done by it.

There are public Acts for the regulation of railways, telegraphs, piers and harbours, water-works, gas-works, &c. If these Acts are defective, or insufficient for their purpose, the proper course is to introduce a Bill for their amendment, and then all parties interested will have—what every individual, be his position what it may, is entitled to—the opportunity of being heard when his property is sought to be interfered with. Whereas the passing of a Standing Order for such a purpose would destroy all those rights, and would, in effect, be making a law that would greatly depreciate private property, without allowing the owners thereof to be heard against it.

The utmost that can with propriety be done in this direction by a Standing Order, consistently with the object and intent of Standing Orders, is to provide that every Select Committee on a Gas Bill shall consider the expediency of inserting a provision in the Bill for all new shares being sold by auction.

It has been said again and again that, notwithstanding the fact that the Gas-Works Clauses Act prohibits the payment of higher dividends than 10 per cent., the companies do contrive, by some means or other, to pay higher dividends than 10 per cent., and cases are frequently referred to in illustration of this. But all this arises from a misapprehension of the facts.

The members of the House of Commons and the public both seem to suppose that all gas companies are under statutory regulations, whereas of the 1600 gas companies in the United Kingdom there are only about 400 under regulations, and the objectionable proceedings on the part of some companies, which so frequently come before parliamentary committees, and cause so much dissatisfaction, do not originate with these 400 companies, but with the others.

When a company are under compulsory regulations, they are compelled to supply gas of a certain standard of illuminating power. They are limited in price, in the amount of capital, and in the rate of dividend, which of late years has been reduced to 7 per cent. upon all new capital, and now it is proposed that all new capital shall be sold by auction.

When a company are not under statutory regulations they can increase or reduce the illuminating power as they think fit, charge any price they may think reasonable, raise any amount of capital required, and pay any dividend they can earn upon old and new capital alike.

The limitation of the dividend upon new capital to 7 per cent. has done more harm to the public than it ever did good, inasmuch as it has deterred many companies from coming under statutory regulations.

If the 10 per cent. had never been interfered with, the majority of the companies would by this time have applied for an Act or a Provisional Order; but while they know the law is such that if they were to obtain an Act they would be limited to 7 per cent. on all their new capital, but that if they carry on their operations without one they may get 10 per cent. or even more, they are unwilling to apply for an Act until they are obliged.

This new regulation, if passed either as a Standing Order or an Act, would only aggravate the end, and make matters worse, for if the companies are unwilling to apply for parliamentary powers now, they would be still more unwilling with this new regulation, and no company would do so who could possibly avoid it, and the companies already under parliamentary powers would exercise all their existing powers to the utmost before they would apply for further powers and be subjected to such unjust regulations.

It ought to be the policy of the authorities to encourage extensions in every possible way. Outside of every large town, there are many places too small to have gas-works of their own, and whose only chance of getting a supply is from some adjoining company; but what company would extend their mains for such a purpose while prohibited by law from making any profit out of the transaction, and might thereby even lessen the profit they were previously earning?

When the auction clauses were imposed upon the Metropolitan Companies, the limitation of the dividend to 10 per cent. was repealed, and the companies were allowed to regulate their future dividends by a sliding scale—that is, if they raised the price beyond a certain standard, their dividend was to be reduced; or if they lowered their price below that standard, their dividend might be increased.

The effect of this is, that as the premiums received on the sales of shares are expended on the works without dividend, the companies are enabled to extend their operations at a cheaper rate than otherwise, and thereby make a larger profit, and consequently pay a higher dividend on the existing capital.

This proposal emanated from the Board of Trade; but the present proposal, which also emanates from the Board of Trade, is to so impose the auction clauses, and not allow the sliding scale. If this regulation were passed, it could only apply to the 400 companies under statutory powers, the other 800 companies would still be entirely independent of it, as they are now. It would, therefore, unavoidably be utterly valueless for the purposes for which it was designed. But even if it were otherwise, it would be an act of great injustice to impose such regulations upon all the companies for the defaults of two or three only, or to make those companies who have voluntarily placed themselves under regulations suffer for the irregularities and defaults of the other companies who have refused to do so.

In whatever way the proposal is to be viewed, it is wholly indefensible. Its operation would be to injure many companies that have honourably fulfilled all their obligations, while it would be unable to reach those who had failed to do so, and it would tend to prevent extensions, to the discomfort of many persons in the outlying districts.

W. LIVESEY.

Gas and Water Companies Association, 6, *Victoria Street, Westminster, March* 31, 1877.

SIR,—By way of exchanging ideas, I send you a copy of a letter I have just posted to the M.P.'s for this city and the North and East Ridings.

CHAS. SELLERS.

York United Gas Company, April 2, 1877.

[COPY.]

Dear Sir,—I am requested by my directors to invite your attention to the following notice which has just been put upon the Votes of the House of Commons—viz., that it will be moved, on the 6th inst., to adopt the undermentioned as one of the Standing Orders of the House:—

"In every Bill by which an existing gas company is authorized to raise additional capital, provision shall be made for the offer of such capital by public auction or tender at the best price which can be obtained."

My directors think you will agree with them that the application of such a principle to gas companies would not only be prejudicial to gas enterprise, but specially harsh and coercive, and therefore they respectfully hope that you will use your influence to induce Mr. Raikes, the Chairman of Ways and Means, not to press the motion.

Of course, if the principle were adopted, every gas company having a Bill either in this or any future session would have to insert a clause, and put up all their new shares to auction. Now, apart from the fact that the introduction of this special legislation upon gas companies, whereby shareholders interests are made unduly subservient to the interests of the public, is harsh, my directors cannot but regard the principle as peculiarly dangerous to commercial enterprise generally; for if the compulsory sale of the privileges which shareholders have hitherto enjoyed, and regarded as their right, be applied to gas companies, it must be seen that it ought to apply equally to railway companies, and all companies of a similar character. Besides, if even the principle were sound, my directors are of opinion that its compulsory application to all gas companies alike, without any examination before committees into the history and peculiarities of a company's capital, or, in other words, into the history of its shareholders, to see whether or not they have even been rewarded at all for their risk and enterprise, would be manifestly unjust.

With these comments, my directors hope that you will oblige them by using your influence against the motion.

(Signed) CHARLES SELLERS, Secretary.

THE CONSTRUCTION OF GAS-GLOBES.

SIR,—There has been much agitation for some time past regarding the improper use of gas for illuminating purposes, but this has been chiefly directed to gas-burners. We wish to draw attention, through the medium of your JOURNAL, if you will kindly allow us, to another important branch of this question that has been all but neglected—viz., the globe and its surroundings, these being as great sinners, where they are used, as the burner itself. We shall only touch incidentally on the globe's surroundings, as the main object we have in view in writing this letter is to draw attention to, and suggest a remedy for, an objectionable feature in the globe itself.

We suppose the globe was originally introduced as an ornament, and this idea has evidently been the one that globe-designers have followed to the present day, leaving utility out in the cold. How the globe would look must have been the leading idea, not how it could be made to conform to the requirements of the flame it had to cover, or how it would affect it. Every one familiar with gas lighting and the use of globes must be aware how a gas-flame is spoiled in appearance, and made un-

steady, by having placed over it a globe of the ordinary kind, such as our gas-fitters shops are filled with. Utility has also been neglected by manufacturers of other *etceteras* connected with gas lighting. Our chandelier makers have designed the parts connected with the globe that they have to do with, regardless of the effect they would have in obstructing the downward passage of the light. For a globe-holder nothing is required but the three forks projecting from the centre, with the necessary screws, and as light as possible for the purpose; but, in addition to this, they have added outside the forks a thick ring of metal, and underneath this is frequently found a saucer-shaped piece of metal, the whole being an area of something like 3 inches of metal, through which the light can scarcely find a crevice to pass. Then going upwards, we find the designer again at work, the results being that the whole combination is crowned by placing on the top of the globe a thing called a coronet, which, though having a very fine name, is always composed of very ordinary material, which becomes discoloured and an eyesore with a few weeks of use. The light being now pretty well guarded from coming out at the top and bottom of the globes, various devices are had recourse to in order to "modify the glare" of the light that comes out at the sides thereof. For this purpose we are favoured with various shapes and thicknesses of ground and opal globes, and thus matters go on, until the whole combination of the designer's art is found obstructing the light to the extent of from 60 to 80 per cent. of that yielded by the naked flame. When people have succeeded in beautifying their gas-lighting apparatus up to this point, they then find out that "they want more light," that "the gas is poor," &c.; and no wonder that this is so. If our architects were to display as much ingenuity in keeping daylight out of our rooms as is here displayed in keeping gaslight out, what would be thought of them?

Though we have thought fit to make these general remarks about the parts connected with the globe, it is not our intention to make a crusade against all the objectionable features here pointed out, but will leave them to be remedied or dealt with by each person in accordance with his own fancy, and content ourselves by taking in hand one feature that is well deserving attention, and which is the main object of our letter—we allude to the 2-inch hole to be found at the bottom of all our 7-inch globes, with the exception of a few opal ones.

We have no idea to whom the honour belongs of fixing the diameter of this part at 2 inches and under, but it is utterly inadequate for its purpose. The column of air it admits is so confined, that in its upward rush it too rapidly oxidizes the centre of the flame, curls up its edges, and produces smoking points, with great unsteadiness that rises sometimes into a roar when the pine-apple shaped globes are used. Why this objectionable feature should have existed so long might have been capable of easier explanation, had there been any difficulty in the way of its removal; but there is none. A remedy is at hand which is simple, effective, and costless, and therefore only requires some one to take it in hand and keep pressing the matter forward until a complete change is effected. This office we have taken upon ourselves to fill.

The remedy we propose is a 3-inch opening at the bottom, instead of the 2-inch hitherto used. This alteration allows the flame to spread itself properly and develop its illuminating power, and imparts to it steadiness; also giving much more downward light than with the 2-inch hole. The difference in effect between two globes of precisely the same pattern—with the exception of the holes—when placed over two similar gas-flames, is so striking that we are perfectly satisfied the earnest attention of the profession and the gas-fitting trade only requires enlisting in the cause in order to have the change rapidly effected.

We know there are 8 and 9 inch opal globes with 4-inch openings at the bottom, but these are not suited, nor are they intended for general use, and they are not the sizes we are writing of. There are also 7-inch opal globes, with 2½-inch openings; but 2¼ inches is not worth altering for, as that does not accomplish the end sought. Though not enough, it is a step in the right direction, and it is strange that this alteration has not been made in the ordinary globes as well as in the opal ones. The explanation is probably to be found in the fact that the opal globes have generally been pushed in connexion with some particular kind of burner; but we want the alteration made for every kind of burner, and for every kind of 7-inch globe, no matter whether it is opal or the kind more commonly used. For this purpose nothing short of 3-inch openings will answer effectively, and this size of hole may be used without interfering with any form of 7-inch globe or pattern on same. The feeling that prompts us to move in this matter is a strong desire to remove one of the greatest defects connected with our gas lighting apparatus, and a feeling somewhat akin to shame, that in the leading gas-consuming country in the world such a defect should continue to exist when it can be so easily removed.

GEO. BRAY AND CO.

Leeds, March 24, 1877.

CLITHEROE WATER-WORKS COMPANY.—The annual meeting was held on the 23rd ult.—Mr. W. B. Dewhurst in the chair—when a dividend of 10 per cent. for the past year was declared, and 3 per cent. paid in addition on account of back dividends. The sale of the undertaking to the Urban Sanitary Authority, on the terms already agreed upon by the directors, was confirmed. Sixty guineas were voted for a testimonial to the chairman, who has so long and ably presided over the company, and brought it to so successful an issue. Forty guineas were also voted to Mr. Wheeler for a testimonial for past services, his connexion with the company as secretary and law-clerk extending over a period of 20 years.

CROOKES'S FORCE.—During the last twelve months, Mr. G. T. Stoney, F.R.S., and Mr. R. J. Moss have conjointly been investigating the behaviour of that force manifested in radiometers known as Crookes's force, and they have laid before the Royal Society some of the results so far obtained. If, as has been asserted, the pressure which is exerted on the blackened pith surfaces re-acts on the side of the glass envelope, then in like way a transparent disc delicately suspended close to a stationary disc of blackened pith ought to move away from the pith, and, therefore, towards the light when the pith is illuminated. An arrangement, described in their paper, was devised to test this. As soon as the vacuum commenced to be formed, the glass disc was repelled from the pith, and the repulsion was more violent as the vacuum became more perfect. The establishment of this fact with regard to this mysterious force, the authors put forward without any expression of doubt. With regard to the influence of variations in the tension of the residual gas, and the variations in distance between the re-acting surfaces, the authors state some results, but reserve discussion till further observations have been made.—*The Times.*

Parliamentary Intelligence.

HOUSE OF LORDS.

MONDAY, MARCH 26, 1877.

The Examiners certificate of non-compliance with the Standing Orders in the case of the Dublin Improvement Acts Amendment Bill, was referred to the Standing Orders Committee.

The following Bills, brought from the Commons, were read the first time, and referred to the Examiners:—Edinburgh and District Water; Falmouth Water; London Corporation; Longton Corporation.

HOUSE OF COMMONS.

MONDAY, MARCH 26, 1877.

The following Bills were read the third time, and passed:—Edinburgh and District Water; Falmouth Water; London Corporation; Longton Corporation.

The Dundee Gas and the West Surrey Water Bills, as amended, were considered.

The Colne Gas Bill was read a second time, and committed.

The Leeds Improvement Bill was reported.

The Ramsgate Local Board Bill was reported, preamble not proved.

The Lowestoft Water, Gas, and Market Bill (Lords) was read the first time, and referred to the Examiners.

Mr. RAIKES deferred his motion in reference to the alteration of the Standing Orders till Friday, April 6.

Mr. WHALLEY deferred his motion for a Bill in regard to Reservoirs till Thursday, April 5.

TUESDAY, MARCH 27.

The Newport (Monmouthshire) Gas and the Waterford Gas Bills were read a second time, and committed.

On the motion of Mr. CHADWICK, a return was ordered, alphabetically arranged, of all joint-stock companies which have, at any time during the last seven years ending on Dec. 31, 1875, failed to make the annual return required by the 26th section of the Companies Act, 1862, showing how often each company had so failed during those seven years.

HOUSE OF COMMONS COMMITTEE.

WEDNESDAY, MARCH 14.

(*Before Mr.* ASSHETON, *Chairman; Messrs.* SMITH, BELL, *and* DUNDAS; *Mr.* BONHAM-CARTER, *Referee.*)

RAMSGATE LOCAL BOARD BILL.

Sir EDMUND BECKETT, Q.C., Mr. VENABLES, Q.C., Mr. BIDDER, Q.C., and Mr. O'HARA appeared for the promoters; Mr. POPE, Q.C., Mr. MICHAEL, and Mr. CHANDOS LEIGH for the Ramsgate Water-Works Company and the Isle of Thanet Gaslight and Coke Company; Mr. SMITH for the Corporation of Margate; and Mr. BALFOUR BROWNE for the owners and occupiers of St. Lawrence, petitioners against the Bill.

Sir EDMUND BECKETT, in opening the case for the promoters, said the Bill was for the purpose of enabling the Ramsgate Local Board to purchase the undertakings of the Ramsgate Gas and Water Companies (as he would call them for shortness), which measure was opposed by those companies, who had also introduced Bills of their own, seeking for further powers. The general issue, therefore, to be tried was whether the two companies who had been supplying gas and water for a very considerable time under very antiquated Acts of Parliament—and, as the local board said, very badly—were to be allowed to continue to do so, or whether the undertakings were, in conformity with more modern views, to be transferred to the local board, who were willing to purchase them at any reasonable price an arbitrator might give. Ramsgate had been governed by commissioners from the year 1787 until 1866, but in the latter year a body of 24 commissioners were authorized by Parliament, who had jurisdiction over the whole of Ramsgate, excepting the parish of St. Lawrence. If the Bill of the local board passed, they would be authorized to supply gas and water outside their own district, but there was nothing unusual in that. The population of Ramsgate was of a very fluctuating kind; in winter it was about 15,000 in Ramsgate itself, and in St. Lawrence 6000 additional; but in summer the numbers rose to 50,000 or 60,000. The rateable value of Ramsgate proper was £75,000, and of St. Lawrence £25,000, although the rateable value of the lighted area in the latter district was only about £15,000. The Ramsgate Gas Company were incorporated so long ago as 1824, and they had had no legislation since, and all they could be said to have done under that Act had been breaking up the streets, charging what they liked, giving gas of what quality they liked, and defying their own Act of Parliament as to capital. They had also power to light Margate, but there they had separate works. On a former occasion, when a scheme similar to the present one had been proposed, the company complained very much of their works being separated, and the local board therefore proposed to purchase their whole undertaking, binding themselves to secure to Margate that portion which belonged to them, a proposition in which Margate was very anxious to concur. They had also power to light Broadstairs, but had not done so, probably because there was another company there. With regard to the proposal to buy the whole of the works, and transfer the Margate portion to that town, there was a distinct precedent for it in the case of the Birmingham Corporation two years ago, when a clause was put into the Act compelling the Birmingham people to sell to the outsiders when they demanded it. One of the restrictions the Ramsgate Gas Company were under by their Act of 1824 was that they were not to supply worse light by means of gas than the town could get from oil, and that gave an idea of the antiquated state of their legislation; but they even ran that test so close that not long ago the local board did actually start oil lamps against them, on account of a quarrel about price. That did not go on for very long, for there was a compromise, but during that time the oil lamps were as good as the gas. With regard to the water company, they were established in 1855, and were practically under no restrictions—that was, such as companies were now subject to. To show the kind of legislative ideas prevailing in those days, he (Sir E. Beckett) would state that the shareholders of the company were to have a preference over every one else in having water. Next to the shareholders, certain streets had a preference; and the rates which they were authorized to levy were as high as 10 per cent. They were not bound to supply any water excepting for the strictest domestic purposes. They had two different works—one at a place called Southwood, which was so near the sea that the water was sometimes brackish; and the other at Whitehall, where they pumped water, which had no fault to be found with it, excepting that it was very hard. There were times when the supply from Whitehall was deficient, and they were obliged to resort to Southwood, which was the case last year, and then the water was so bad that it went by the name of the "Ramsgate Mixture," not quite equal to Epsom salts, but something approximating to it. The principle involved in Bills like the present was, that where there was no strong intervening reason to the contrary, gas and water works were better in the hands of the local authority. That principle was taken from the Public Health Act, which recited that, where there

was a gas or water company in existence, the local board or the corporation should not be allowed to set up competing works of their own until they had satisfied some public authority that those companies could not do their work properly. That legislation was devised by some benevolent party who was anxious to save the legal expenses incurred; but it had proved to be unworkable, and there was not a single instance in which it had been practically and effectually put in force. That Act was mentioned merely as pointing out the general principle, the leading feature of the Act being that there should be a company in existence capable of doing the right thing; but when that was not the case, Parliament had invariably applied the only remedy it could apply—viz., placing the works in the hands of the local authority, who would, of course, be anxious to do what was right. The question to be determined was, had the companies been doing their work properly; but upon that there might always be some difference of opinion. [The learned counsel cited the cases of Rotherham, Stockton and Middlesbrough, Dundee, Glasgow, Leeds, and Neath, in all of which cases Parliament had acted upon that principle.] With regard to the Ramsgate Gas Company, when he stated that they were under no restrictions at all in their original Act—except about giving gas equal to oil—he thought he had said enough to satisfy the committee that they ought to be under parliamentary regulation as to that matter. As to price—not merely as regarded domestic lights, but also the public lights—there had been grievous complaints. The answer would doubtless be, "That is all very true, but here we are with a Bill." They were before Parliament with a Bill last year, because they found at the end of 1875, if they did not do so they would have no answer whatever to the Bill brought forward in 1875-76 by the local board to buy them. They, therefore, brought in a Bill of their own to oppose the Bill of the local board; but, under advice, they withdrew their Bill just before going into committee. His learned friend, Mr. Pope, knew what the result would have been—viz., that if the committee found that the companies had been conducting themselves as the companies knew perfectly well they had been doing, their Bills would be rejected, and the Purchase Bill would pass, and, therefore, as a matter of tactics, they withdrew their Bills. By introducing those Bills in 1875-76, the companies admitted they ought to be brought under parliamentary control, and they were only withdrawn in order to carry out their selfish policy of protecting their large dividends from either being bought up at a fair price by the local board, or restricted by Parliament. If they were *bonâ fide* anxious or willing to be under parliamentary control, why did they refuse last year to be put under such control? That alone justified the local board in asking the committee to sweep them out of existence; but it would be sweeping them out with a golden broom, because they would be paid the last farthing an arbitrator would give. The preamble of the gas company's Bill of the present year stated the conditions upon which they were kind enough to allow the committee to put some control upon them—"Provided the capital of the company be declared and readjusted as hereinafter mentioned." Then they were willing that they "should be subject to the powers, regulations, and restrictions of the several statutes incorporated in and by this Act." That was to say, "If you will give us the bonus for which we ask, we will submit to be regulated." What was that bonus? By their original Act they were authorized to raise £24,000, by shares in the ordinary way, and no more; but of that amount they only issued £16,000 in a straightforward way. What they proposed by the present Bill was to convert that £16,000 into £16,000 *plus* £48,000. They did not want legislation about the £16,000, or rather the £24,000. By clause 5 they proposed that "within a period of six calendar months after the passing of this Act the company shall create stock, to be called improvement stock, to the amount of £48,000, and shall issue and distribute the same as soon as created, as fully paid-up stock, to and among the shareholders of the company in proportion to the shares in the company held by each shareholder." They proposed to justify that by stating that they had expended out of profits, from time to time, a sum equal to £48,000, and, not only that, but another £8000, the difference between £16,000 and £24,000, because they had never raised by a regular issue of shares more than the original £16,000. In other words, having issued by shares £16,000 only, they proposed to make that capital £72,000, thus inventing a purely fictitious capital of no less than £56,000. It was quite true that they limited the dividend on that imaginary capital to 6 per cent., but they kept to 10 per cent. on the original capital of £16,000, and that could not be complained against; but they also asked for 10 per cent. on the £8000 which had not been raised by shares; and, besides that, they asked for power to raise a further sum of £32,000, on which they asked for 7 per cent. With regard to the negotiations which had taken place, he (Sir E. Beckett) found that the local board had offered a sum which almost looked as if they had been improvident, as it amounted to something like £140 a share for their nominal £25 shares, on which they had only paid up £20, and he sincerely believed no arbitrator would have given so much. The company, however, had not accepted it, and he only mentioned it to show that his clients had been desirous of dealing with the gas company on the most extravagantly liberal terms; but they had refused all the offers which had been made, and, finally, intimated to the promoters that, if they were audacious enough to think of coming before Parliament again, they should ask the committee to give them their costs. [The learned counsel then referred to the agitation in the town, to the meetings at which resolutions in favour of the Bill had been carried by large majorities, and subsequently to the results of the poll, under the provisions of the Borough Funds Act, which was very largely in favour of the local board.] The dividends which the gas company had been paying since 1862 were £2400 a year—that was to say, 15 per cent. upon their properly called-up capital of £16,000. It was perfectly well known that the chairman last year called it £24,000, but, if he had chosen, he might have called it £72,000; but, if they had been before Parliament, everybody knew they would not have been allowed to divide more than 10 per cent. Treating the water company in the same way, they were authorized to issue originally £15,000, which they had done with the exception of £1000 (but it was not worth while to dwell upon that distinction), and they had been dividing for the last seven years 10 per cent. upon the £15,000, so that the water company had not been in a very bad condition. It had been mentioned in a general way that the quality of the gas had often been very bad, although latterly, of course, as might be easily imagined, it had been a great deal better. On one particular day it had been extremely good, and the inhabitants could not tell what had happened to it; but it appeared the gas company knew some one was going to examine the gas, and on that day it was beautiful, although it very soon relapsed into its former condition; but water was not so easily brought up to a given mark in five minutes as gas was, because, in order to bring up water to the requisite supply, there must be proper water-works, and it did not suit the company to have proper water-works. As far as quantity went, the statement made last year by the witnesses, and only to a certain extent qualified by the other side, was that when the town was full they gave the extravagant supply of about six or eight gallons per head per day, and no comment need be made upon that. Of course, when the town was empty, they could give a great deal more; but, unfortunately, people must drink when the town was full as well as when it was empty. Some person talked about averages, but stomachs were not capable of dealing with averages. Where there was a gravitation scheme involving a large reservoir, if an extraordinary demand came upon the company, they could not meet it, because making reservoirs was expensive; but where it was only necessary to draw more adits, or to put down more pumps, it was simply audacious not to do it. The water company had, however, been pursuing that course for several years. The committee would not be surprised to hear that the medical officers had complained over and over again; and by violent efforts the company at last, having refused at first, actually consented to break the Sabbath. No doubt the company would take credit to themselves for having done so, but it had only been lately, and they were not enabled to plead their late concession as an answer to the complaints which had been going on for 30 or 40 years against both these companies. They had also the unusual power of putting in the fittings and connexions themselves, but they had not attended to that matter as they ought to have done. If it had been for the inhabitants to do so, of course the company would have had a ready answer to the complaints—viz., that it was their own fault—but as they had the unusual power of putting in the connexions themselves, if anything was wrong it was their fault, and not the consumers. There was also a grievous want of water in case of fire, and that was another reason for transferring the works to the corporation. Another thing complained of was that the mains were laid too high in the streets, so that they were constantly getting broken by the heavy traffic, and that involved breaking up the streets to relay them. Further, he (Sir E. Beckett) understood the company had no map of their mains, and consequently they had to go pricking about to find them. The water company also proposed by their Bill to raise more money, but they did not want to capitalize so much as the other company did, and therefore they had not the same strange provision in their Bill. They did, however, ask for power to capitalize £15,000. For many years past Parliament had refused altogether to recognize the capitalization of profits, and that was especially the case with regard to the Chartered Company in 1867. Turning to the petitions, the learned counsel said the first was from certain inhabitants in the district of St. Lawrence, who said that "the supply of both gas and water had been, and still continues to be, satisfactory as to quantity, quality, and price." He would not suggest that there might be reasons why they were not particularly anxious about the quantity of the water—perhaps they did not use it much for baths, and the quality of gas they probably did not care much about. "The object of the promoters of the above Bill is to obtain, by agreement or compulsory sale, the undertaking of both companies, and your petitioners object to the transfer, which they believe will injuriously affect them, more particularly as the local board openly profess that by means of it they may be able, out of the profits of the undertaking, to provide, to a large extent, funds for the improvement of the district." He (Sir E. Beckett) did not know that his clients did profess that, but he would tell the committee what they really did profess, and what every corporation professed in those matters. Where there were a gas and water company, and still more in an increasing place like Ramsgate, they went on continually increasing their capital, and either legally or illegally they took upon their capital something considerably more than the amount at which a local board or a corporation could borrow money. A corporation in most cases could borrow money at 4 per cent., and sometimes at something less, but no company thought of taking for their new capital less than 7 per cent. The difference, therefore, between the 4 and the 7 per cent. continually went, as fast as the capital was expended, into the pockets of the shareholders of the company, instead of into the pockets of the community at large. It was not the wish of the promoters to interfere at all with the past profits of the company, because it was certain that any arbitrator would take care of them on that point; but as to the future, they respectfully submitted that the profits ought to go into their pockets, and not into those of the company, and that could only be done by introducing a novel form of legislation—viz., reducing the dividends upon their new capital to 4 per cent., to which the company would immediately answer, "We cannot raise new capital at 4 per cent." The promoters were also introducing a novel—and certainly unusual—proviso at the end of clause 89: "Provided always that if such undertaking has been transferred to the board subject to any mortgage debts, the interest on the same, according to their several priorities, shall be paid out of the revenue of the board from such undertaking, immediately after payment of the establishment charges, and in priority to all the other purposes in this enactment specified, and the balance (if any) of any moneys received on behalf of such undertakings respectively shall be applied in equal moities in reducing to the consumer the cost of the water and gas respectively supplied under the authority of this Act, and in increasing the district fund." He (Sir E. Beckett) did not know of a single precedent for that clause; the invariable practice had been that whatever profits the corporation were able to make, went to the district fund, and nobody had any right to inquire and go behind that.

Mr. MICHAEL said there was one case—that of Stockton and Middlesbrough.

Sir E. BECKETT had no doubt his friend was correct; but in the previous year the Birmingham Corporation resisted it most strenuously and successfully. They said, "We are answerable to our ratepayers; if they choose to let us go on making profits upon the gas and water works, they are quite competent to do so." In the present case they actually made a present of one-half of the profits, whatever they might be. The petition then stated that "it must be obvious that if the charges of the local board for water and gas in Ramsgate and St. Lawrence should be uniform, the effect of the Bill will be that the consumers of gas and water in St. Lawrence will be required to contribute largely to the costs of the general improvement of the district of Ramsgate without deriving any corresponding benefit from such improvement; and if, as is possible, and the Bill allows, the local board charges for gas and water consumed in St. Lawrence should be greater than the charges for gas and water supplied in Ramsgate, inasmuch as both companies now make the same charges within both parishes, a great injustice would be inflicted upon your petitioners." That was a mere question of clauses, and there was no principle involved in it, and no preference had been given in the Bill to Ramsgate over St. Lawrence. Then the petitioners said they were of opinion "that the affairs of both companies would be better and more economically managed by a board of directors, who, as shareholders, would have a large pecuniary interest in the companies, than by a committee of the local board, who would only be affected to the extent of a very small amount which they might contribute as ratepayers or consumers." In other words, they were of opinion that it was more economical for the public at large to have a company going on raising money at 7 per cent. than to have a corporation raising it at 4 per cent., and they might establish that proposition if they could. Against the petition might be paired off one from the Margate Corporation, who said, "Your petitioners are of opinion that it is most desirable that the supply of gas within their district, and the neighbourhood thereof, should no longer remain under the control of the company, and that the speediest means of effecting a transfer of the undertaking to your petitioners, as the representatives of the interests of the public, would be by the passing of the Bill, with suitable clauses properly devised, providing means for the transfer of the Margate portion of the undertaking to your petitioners upon equitable terms; but your petitioners

object to the clause for that purpose inserted by the promoters." Of course, that clause was quite open to discussion afterwards. The St. Lawrence people might say, "You are going to transfer the works in Margate to Margate, but you are not going to transfer the works in St. Lawrence to St. Lawrence." True, they were not; but he said again, "Your remedy for that is to join the Ramsgate Local Board, instead of keeping up your miserable independent existence. Why cannot you have one government representing both of you, and then you will have the same control over gas and water." But there was another petition of inhabitants of St. Lawrence, and they said that they complained greatly "of the supply of gas by the company within the parish of St. Lawrence, and to them individually; and that the price charged is unnecessarily high, and that the gas is bad in quality, and very deficient in quantity." One of the constant complaints which had been made against the gas was the deficiency of pressure, which had been sometimes so great as to cause people to light candles in addition to the gas. They also said, "Many of your petitioners have experienced great difficulty in obtaining a supply, and others of them have been unable to do so for various purposes. The public lamps within the said parish are very badly supplied, and are greatly neglected, and in many instances the company refuse to put up and supply new lamps when required to do so, while at the same time the price is too high." The petitioners then stated several other things, concluding with the hope that the Bill promoted by the local board would pass. Proceeding to the petitions of the companies themselves, the water company complained that £60,000 which the local board proposed to borrow was not enough for the purposes of the undertaking, but if it were not, the purchase could not be carried out till the money was paid, and the local board must apply to the Local Government Board for more; but that would not influence at all what the arbitrator might do. They also said that they had always given a good and sufficient supply of water—that was the six or eight gallons a head—and they denied the statements contained in the preamble of the Bill. In the petition of the gas company, they stated: "By the Bill the local board seek to borrow, on security, to an amount not exceeding £150,000 for your petitioners undertaking, which sum is altogether insufficient," for the purchase of an undertaking representing £16,000 worth of shares. In another part of the petition they again raised the question of the separation of the works, and they called attention to the fact that the promoters were not only seeking to supply their own district with gas, but were proposing to include Margate and a large area outside, "and that therefore a great injustice would be done by allowing the Bill to pass, and great confusion would arise thereby." He (Sir E. Beckett) would like to know what injustice and what confusion. Last year the local board did propose to separate them. The companies were as difficult to please as the man who was flogged either too high or too low. In last year's petition they said: "As the Bill is proposing only to acquire a portion of the works of your petitioners, great injustice will be done, and great confusion arise thereby." Last year they said great confusion would arise because they only proposed to purchase half, and this year they also said confusion arose because they proposed to purchase all.

The following evidence was then called:—

Mr. *W. A. Hubbard*, examined by Mr. O'Hara.

I have been clerk to the Ramsgate Local Board since 1868. When I first entered the service of the board the question of the public lighting was frequently discussed by the Watch Committee, on complaints being made that the public lamps were not properly attended to. In 1869 two letters were sent to the gas company from the Watch Committee, on the subject of the neglect in the public lighting. To the first of those letters we received a reply, and some of the lamps were altered, but not all of them; in fact, I think the greater number of the lamps in Ramsgate still have large apertures, which allow the lights to be blown out. In 1870 the local board made a proposition with respect to the lighting of the West Cliff promenade—which was then unlighted—to the effect that the board should erect six lamps there, and that they should have the power of putting them out when they wished, but the gas company declined to allow that. In 1871 we made further application, and we then agreed that the promenade should be lighted on the same terms as the other lamps in the town, but the gas company insisted upon our paying half the cost of the main. Up to the middle of 1873 the charge made by the gas company was £3 12s. for what were termed permanent lamps, and £3 1s. for non-permanent lamps—viz., those that were extinguished during moonlight nights. [Witness read a lengthened correspondence which had taken place between the local board and the gas company, the substance of which was as follows:—On June 3, 1873, the directors gave notice that after the 30th of that month the charge would be £5 per annum for the permanent lamps, and £4 15s. for the non-permanent lamps. The directors, however, stated that they had no objection to charge by average meter indication, all expenses being borne by the local board, when the cost would be 6d. less than the amount charged to the public, and 13s. additional each lamp for lighting, putting out, and repairing, if done by the company. In their reply, the local board stated that they could not admit that the company were in any way justified in making such an extraordinary demand, but they would not object to all the lamps being lighted as permanent lamps, at a charge of £4 4s., including lighting, putting out, cleaning, and repairing. The directors, however, declined to alter their proposed charges, which they said were arrived at after much inquiry and consideration. In August, 1873, the local board made an offer to pay £4 5s. 6d. for the permanent lamps, and 12s. less for the non-permanent lamps, which was declined by the gas company, who expressed their willingness to accept £4 15s. per lamp, provided all the lamps were made permanent, and the accounts settled quarterly. In October, 1873, the local board applied for an abstract of the accounts of the gas company for the preceding three years, as the board felt a little sore at the high charge proposed, but the company refused to supply those accounts. For the quarter ending Sept. 30 the gas company sent in a claim for £296 16s. 3d., which was at the rate of £5 per annum for each permanent lamp, and £4 15s. for each non-permanent lamp; upon which the Watch Committee called the attention of the gas company to their letter of Sept. 8, offering to accept £4 15s., provided all the lamps were made permanent, and stated they would recommend the local board to agree to those terms, provided the charge of £5 was withdrawn, but this offer was refused by the gas company, and an immediate settlement of the account was pressed for, or the lighting would be discontinued. After some further correspondence on the subject, which led to no result, the local board, on June 24, 1874, forwarded to the gas company a resolution which had been arrived at—that half the public lamps should be discontinued. That arrangement, however, was found to be most inconvenient, and after about three months another resolution was passed, ordering the lamps to be relighted; and the gas company subsequently sent a letter to the local board, in which they expressed a hope that in a short time they would be enabled to make a reduction in the price of gas. Several letters afterwards passed between the parties, on the subject of bad and deficient lighting, in the course of which the gas company contended that, owing to the exposed situation of the lamps, the number was very small, being less than 1 per cent. With reference to the parliamentary proceedings, negotiations were opened by the local board in October, 1875, to effect the purchase of the gas and water works, but those negotiations failed. Since that date renewed correspondence had taken place with the gas company, and on Jan. 3, 1877, a copy of a resolution was forwarded to them, offering to purchase the whole of the undertaking upon the terms of perpetual annuities of £5 each on the 800 shares issued, together with a payment in money of £15 per share, and in addition £5000 to be paid as compensation to the chairman and directors. In reply to that communication the directors refused to entertain any such proposal, and expressed their intention, should the local board persist in their attempt to acquire the property of the company, to ask Parliament to recoup the company any expense to which they had been put by the proceedings of the local board. On Jan. 26 another letter was sent to the gas company from the local board, stating that a poll of the town had been taken, which was largely in favour of the board, and asking whether the company were inclined to reconsider their decision. To that letter an answer was received on the 5th of February, stating that the directors did not consider it necessary to reconsider the question, and that closed the correspondence with regard to gas. With regard to the water supply, several letters were read, complaining of the absence of water at fires, and also asking that a constant supply should be given to the town-hall, to which latter request the company declined to accede. Another letter enclosed a report from the Medical Officer of Health, suggesting the desirability of a supply being given on Sundays as on other days, and to that proposition the company acceded by turning the water on for a short time every Sunday. A complaint from the local board of the limited time during which the water was turned on, and asking for an additional hour, was met by a reply that the water was laid on for a period sufficient to fill all the cisterns with which every house taking the water ought, by a clause in their Act, to be provided; that the time averaged two hours, and that no complaint had been made to the company of a deficient supply. Some further correspondence ensued as to the advisability of giving a constant supply, which the directors stated they were compelled to defer; but as they were desirous that such a supply should be afforded, they were quite prepared, if supported by the local board, to promote a Bill in Parliament with that object. The correspondence closed with an offer of purchase by the local board similar to that forwarded to the gas company, and its rejection by the water-works company, on the ground that the directors believed that it was contrary to all parliamentary precedent, as it appeared to them to be inconsistent with good faith that a public company should be deprived of their property and privileges against their consent, and only because others had a wish to possess them.]

The Rev. *E. G. Banks*, examined by Mr. Venables.

I am head master at the Chatham and Rock House School, at Ramsgate, and chairman of the Finance and General Business Committee of the Ramsgate Local Board. I have lived in Ramsgate for more than four years, and I think I am the largest ratepayer, except the Granville Hotel. The population of Ramsgate, according to the census of 1871, was 15,600 odd. The census is taken in March, which is the lowest time for the population of Ramsgate, because, when we get the March winds, it drives all the visitors away. The population of Margate is a little less, but not much. The minimum population of St. Lawrence is about 5000, in round numbers. At the height of the season, I should think the population of Ramsgate, including St. Lawrence, is between 50,000 and 60,000. The rateable value of Ramsgate is between £73,000 and £74,000, and that of the lighting area of St. Lawrence about £15,000. In the two places there are about 4000 inhabited houses. The Isle of Thanet Gas Company have power, under their Act, to supply Ramsgate, St. Lawrence, Margate, and Broadstairs, but they have never supplied Broadstairs. Ramsgate and Margate are supplied by different works, but under the same management. During my residence in Ramsgate there has been dissatisfaction from one end of the place to the other. I hardly go into a single house or shop where I do not hear dissatisfaction expressed; but it has not been so much lately, as the company have been upon their best behaviour since their application to Parliament last year. The principal evil complained of has been the high charges—by which I mean that, inasmuch as the company have been paying such high dividends, they ought to have lowered the price. With regard to the public lamps, whenever they have had a chance they have endeavoured to raise the price; and, moreover, they charge us at Ramsgate, though we are the most paying part of their undertaking, more for the public lamps than they do at Margate. The present charge for gas is 4s. per 1000 feet; but there are other expenses to the consumers besides the gas-rental. I have made inquiries, and I find that our company are almost unequalled in the kingdom for the way in which they charge the consumer for laying services, and so on. If a man is living in a £10 house, and wants to have the gas laid on, he has to pay 6s. in advance for a 3-light meter—that is 22 per cent. upon the net cost, which is £1 6s.—and then he has to pay for his own service from the main. Taking a three-quarter inch pipe at 6d. a foot, and an average of 20 feet, there is another 10s. he has to pay, whereas the actual cost would be only 2d. a foot to the company. Then they charge him for the labour of putting this on, and they make him fetch his own meter from the gas-works, and then make him pay for his own main-tap and inlet; so that altogether, if a poor man wishes to have the gas laid on, he has, first of all, to pay from 40s. to 50s. So prohibitory is it, that out of our 4000 houses, only about 1400 are supplied with gas, and nearly all those that are supplied voted for the transfer to the local board. There is also a complaint about the way in which coke is dealt with, because the company charge 12s. per chaldron on the spot, while they send it away in large quantities out of the town at 5s. a chaldron. They have never tried what a good reduction in the price in Ramsgate would do. At the fall of last year they raised the price 1s., and then, when they found they had got such mountains of it that they did not know what to do with it, they lowered it 1s. this year. If the local board had the works, they would probably open a room with stoves, to teach people how to use coke. At Margate the price is the same as at Ramsgate; but it ought to be more, because to get a ton of coal to Margate the dues and freights, and so on, cost at least 2s. per ton more than to get it to Ramsgate, and, therefore, if they make 8000 feet per ton of coal, the price should be 3d. less at Ramsgate than at Margate. Our arrangement is to part with the whole of the Margate works to the corporation there; we do not propose to make a profit, but to hand them over for what they cost. The price of gas in Ramsgate was 4s. in 1870 and 1871; 4s. and 4s. 6d. in 1872; 4s. 6d. and 5s. in 1873; 5s. in 1874; 4s. 6d. and 4s. in 1875. What we object to is not the 4s. in the abstract for 1000 cubic feet, but with all their profits 2s. 6d. would have been a fair price to have charged in Ramsgate. When we tried the oil we found it quite as good as the gas, but it was too much nuisance and bother. The charge for each public lamp, burning 4 feet an hour, is £3 7s. 10½d. We commenced the average meter system on Jan. 1, 1875; that was because the company proposed to charge us £5 per annum each lamp. They allow 10 per cent. discount on the public lamps; but they allow 6d. in the 4s. at Margate, which is more, of course, but I do not know how the difference arises. The charge for cleaning is 17s. 6d., and I think they charge Margate something about the same. New lamps are constantly being required; but I know that St. Lawrence has had great difficulty in getting them put up. We had some put up upon the West Cliff promenade, and they charged us about £70, while the prime cost to them was about £42, and we had to supply the labour. In 1875 we had an interview with the directors of the gas company, and asked them to show us the state of their

capital account; but they could not tell us anything, and there were no documents published by which we could learn for ourselves. We did, however, ascertain the state of their accounts from the cross-examination of their witnesses. Mr. Curling said the original cost was divided between the two places, and that gave £7705 for Ramsgate. Then from 1835 to 1847, £3024 were spent on works; from 1847 to 1862, £5899; and from 1862 to 1875, £22,955; making a total spent on Ramsgate of £39,583. The original cost of the works in Margate was £7705, the same as for Ramsgate; then from 1835 to 1847, there were £2256 expended on works; from 1847 to 1862, £5624; and from 1862 to 1875, £24,804; making a total for Margate of £40,389. The two together made the total sum spent on capital, £79,972. The amount of capital paid up was £16,000; therefore they have got out of the consumers, £63,972, which they have put to their works. During that period they have also paid in dividends £67,320, so that the whole amount the consumers have paid has been £131,292, which works out for 51 years to an annual average profit of £2574 6s. 8d., or equivalent to an annual average dividend, on the £16,000 invested, of over 16 per cent. Mr. Curling made out the annual average dividend to be £1 16s. 5d., taking a capital of £72,000. The company began to pay what they called a 10 per cent. dividend in 1862, and they have paid it uninterruptedly since. They paid that dividend upon the £24,000, which was 15 per cent. upon the capital subscribed; and besides that, they took out of the consumers pockets £48,000, which, if worked out over the 14 years, would give a profit of 36 per cent. The £24,000 was arrived at by two resolutions of the directors, adding £4000 each time. Under their Act it was expressly stated that they were not to subscribe the extra £4000 unless the £20,000 was found insufficient for the carrying on of the works; but as they subscribed no more than £16,000, I say they could not legally take that extra £4000.

Mr. VENABLES: Do you know, as a matter of fact, whether their extensions have been principally of late years, or whether the larger proportion of them were in the earlier period of their existence?

Witness: I am certain that if Mr. Curling had not, last year, given us the average of the previous 14 years, from 1862 to 1875, but had given us the average from 1870 to 1875, he would have found that most of the profit was made in those years, because that is when the principal extensions took place. Regarding the disturbance of the streets, they never tell us beforehand when they are going to do it, nor do they tell us afterwards until some time has elapsed, so that we have to find out for ourselves. We have no power over them under their Act, and if we do complain they treated us with great discourtesy. The feeling of the town is very strongly in favour of the lighting being taken over by the local board. There was a meeting of ratepayers, at which a resolution was proposed in favour of our Bill, and then speeches were made against it, and a poll demanded. It was opposed really by the gas company, only they were clever enough not to appear, but set up other people to do it. That was proved in this way. A list of questions was asked by the gentleman who demanded a poll. I do not think he knew he was being made a tool of by the gas company; but I asked him to hand me up the paper, and said I would answer him in detail, and it turned out that those questions were written for him by one of the firm of solicitors, so that they were evidently acting in league together.

Mr. MICHAEL: I am sorry to hear this gentleman make this loose and wild statement. I am instructed it was never written by one of the solicitors to the gas company.

Witness: It is in the handwriting of Mr. Arthur Daniel, and he acknowledged to me that he wrote it.

Examination resumed: The meeting at which the show of hands was decided in favour of the resolution to promote the local board Bill was crammed; I should say there never was such a meeting in Ramsgate. Since that meeting two long letters have been written to the Local Government Board by the opponents of the Bill, asking them to withhold their consent to the payment of the costs out of the district rate; but the Local Government Board have not complied with their request. Since this matter was first started, there have been two elections on the local board—one in 1875 and the other in 1876—and the question of the local board taking over the gas and water companies was made a material test at these elections. The result was that, out of the twelve members elected in 1876, eleven were in favour of the transfer.

By Mr. MICHAEL: A gas director was at the head of the poll; but as all his friends plumped for him, I do not think there was anything very wonderful about that. I myself gave him all my votes to show there was no ill feeling, and he was a man very well known in Ramsgate.

Examination resumed: That result was obtained under the cumulative voting system. Of the present local board every individual member has approved of the purchase with three exceptions. During the last two or three years we have made two or three offers to purchase, and we are still willing to agree to the terms we proposed. There are very few shareholders who live in Ramsgate or Margate. The shares in the gas company were sold in the market at £75 since last session. They have been lower, but agitation of this kind always sends the shares up in the market. Of course, I object very strongly to the Bill introduced by the gas company. If we purchased the property of the gas company we would give for payment the security both of the gas property and of the district rate, although the gas property would be quite enough to secure it.

Mr. VENABLES: The proposal of the company is first of all to take their capital at £24,000, whereas you have said there is only £16,000 paid up, and upon the £24,000 to have 10 per cent.—that is to say, to have 15 per cent. in perpetuity upon their capital. Then they ask for £48,000, which they have taken from their revenue and applied to capital account at 6 per cent., and then they ask for £32,000 additional capital at 7 per cent., which would mean a very heavy tax upon the gas consumers?

Witness: Yes; and then there is the money they propose to borrow upon mortgage—viz., £26,000 at 5 per cent., so that the total entailed upon the town if their Bill were passed would be £8820, whereas if the local board Bill passed the charge upon the town would be only £4495, so that we should save £4000 a year to the two towns—£2000 to Ramsgate and £2000 to Margate. The maximum charge in the gas company's Bill is 5*s.* 6d., which, of course, is much too high, but it does not matter about that so much if we can only tie them down according to the terms of their maximum dividend.

THURSDAY, MARCH 15.

Rev. *E. G. Banks* recalled, and further examined by Mr. VENABLES.

The limits of the water company's supply are, practically, now Ramsgate and St. Lawrence. They originally had power to supply Minster, but they were not to supply that place unless they did it within a certain time, which they allowed to lapse, and the local board now propose to take that power. There are two works—one at Southwood and the other at Whitehall. Southwood is on the higher level, and according to Mr. Easton's evidence last year they do not pump often there, because they have had the salt water in. We maintain that another reason why they do not pump is because they are afraid of the cesspools round. We also say that in the summer there is not sufficient water at Whitehall, and therefore the two waters must be mixed. The Whitehall water is tolerably good, but it is too hard and too full of nitrate of lime. It is not submitted to any softening process. Mr. Easton said that the greatest number of gallons which they pumped in the summer was 427,000, but we maintain that they want at least a million gallons a day in the summer, when our population is at its maximum. Mr. Stride said that the Chatham and Dover Railway took, speaking roughly, 4½ million gallons of water during the year. We also know that the South-Eastern Company take rather more than that, so that there are 10 millions to be provided for. Then there is the water for flushing, and for the streets, and if you take 50,000 inhabitants at 20 gallons there alone is one million; so that if we say we want about one million, we are within the mark—I mean for Ramsgate and St. Lawrence. The maximum rate chargeable by the company, which they do not propose to alter by their present Bill is £7 10s. per cent., either upon the assessable value or upon the actual rental, at their option. The present charges are as follows:—At or below £50 rating, 13½d. in the pound; between £50 and £60, 12½d.; between £60 and £70, 11½d.; between £70 and £80, 10½d.; above that it is by special agreement with the directors. For washing carriages the charge is 1s. per 1000 gallons, and the same used to be the charge for flushing purposes in the town; but since the last parliamentary session they have agreed to lower it to 9d. per 1000 gallons, provided we take three million gallons in the year. I think those charges are excessively high, especially considering the amount of profit they have been making. Mr. Curling stated last year that the capital contributed was £14,000, and that the works cost £34,000—that is to say, that the consumers have found £20,000—and since the formation of the company dividends have been paid of £34,373, so that the total is £54,373 profit which they have made, giving a yearly average over the 40 years of £1359, equalling an average dividend on the average invested capital—viz., £11,350—during those 40 years of over 11¾ per cent.

Mr. VENABLES: What do you mean exactly by the average invested capital?

Witness: I am taking the table of dividends and of the capital which Mr. Curling gave in last year. Since 1849, which is one of the divisions given by Mr. Curling, it appears that £27,821 was paid in dividends and £19,000 added to capital account, which amounts to £46,821, or equivalent to an annual average dividend on the average capital employed for those 27 years (that is to say, the average capital coming to £12,815) of £1734, or 13½ per cent. But if we take the abstract of accounts for 1873–5, we find that the average profit for those last three years has been £2620, so that the dividend upon the £14,000 really invested is over 18½ per cent. for the last three years. The offer we made to the water company was as follows:—There are 1500 shares at present receiving 10 per cent., or £1 dividend in a year, and we offered them perpetual annuities of 30*s.* on each share, and a money payment of £3 on each share, together with £2000 for the directors. We think these are high terms, but we are still willing to give them if the committee think fit.

Mr. VENABLES: Do you think that you have generally reason to complain of the supply, independently of the capital and of the price?

Witness: Yes; principally upon the score of quantity; we do not get anything like the amount we ought to have. The quantity of water is very important for a place like Ramsgate, which depends entirely upon its health. It is a sanatorium for London, in a great measure, and if the sanitary condition of Ramsgate is bad, many inhabitants suffer, because the whole of their trade is gone. There are cisterns in the place, but there is not a constant supply, and that is one of the reasons why we come to Parliament—viz., to get a constant supply. The time of the day at which the water is turned on varies in different places. In some parts it is only on for perhaps an hour and a half early in the morning, and so inconvenient is that, that the poor people, if they are not up in time in the morning when the water is on, cannot get any all day, through not having cisterns, and we have no power to compel them to have cisterns. They fill every pail they can get hold of when the water is on, and it has to be kept standing all day. Then as to watering the streets, and as to water for the sewers, we continually want water for this purpose, but we are prevented from taking as much as we want, because of the high charges. Then, again, they will not always give it to us when we want it for flushing, simply because they have not got it. Once when we wanted to flush, they said we could not have the water until they had supplied the shipping, although their Act expressly says they are not to supply the shipping until they have supplied their other customers, and I suppose the local board may be considered as one of their customers. I know that a constant supply requires constant inspection of fittings, and the company have practically had no inspection whatever. I believe that the collector of water-rents is supposed to be the inspector; but when it was mentioned last year that he inspected the fittings, everybody laughed. We have no power to supply that defect, because if we have power to compel the owner to supply a cistern for his water-closet, there our power ends, because it is for the water company to put on the water, and if they do not leave it on long enough we have no power in the matter. Another reason why the supply should be in the hands of the local board at Ramsgate is, because we have been lately closing up all the wells in the town, because we had a report that they were unfit for drinking purposes, and thus we compel people to pay water-rates who never paid them before. We therefore think that if we compel people to shut up their wells, and thus swell the income of the water company by compelling them to take their water from the company, we ought also to have water to give them as cheap and pure as possible. I should say it is perfectly impossible, according to modern notions of sanitary science, to be a proper sanitary authority, unless you have the water under your control. The local board are so anxious to get the water, that they are desirous that the committee should direct the principle on which the compensation is to be assessed for the purchase of the original works. I may also remark that we shall never rest in Ramsgate until we do get it, at one time or another, into our hands.

Mr. VENABLES: Of course, the water company can have no interest in the whole concern, excepting as regards the income which they derive?

Witness: That is all. I do not use the term offensively, but their policy must be a selfish policy for their shareholders, whereas ours is simply for the good of the public. If they obtain their Bill and we do not, I do not know when we can get hold of the water-works afterwards, because we can only catch them when they are in Parliament. Last year both companies had Bills in Parliament, and they withdrew them, and the inference is that if they do not obtain what they want they will again withdraw their Bills, unless the local board Bill remains before the committee.

Mr. VENABLES: I see there is, in clause 89 of your Bill, a provision that "the balance (if any) of any moneys received on behalf of such undertakings respectively" (that is, in short, the profits) "shall be applied in equal moieties in reducing to the consumer the cost of the water and gas respectively supplied under the authority of this Act, and in increasing the district fund?"

Witness: Yes; we wish to act fairly to both parties. I do not think it matters at all as regards the water, because we intend, if we get it, that every ratepayer shall be a consumer of water; most of them are so now. As to gas, we thought it was fairer, as the consumers had had to pay so much to make that division of profits—inasmuch as they had, out of their pockets, contributed large sums for the maintenance of the works of the company—that they should have some return.

Cross-examined by Mr. BROWNE: We are anxious to get rid of the existing state of things, by which one side of the street is in Ramsgate and the other side in St. Lawrence; and to accomplish that we are desirous of extending our district, but we have no proposal at present before Parliament with that object. After paying the large sum we have offered for the gas and water works, I do not say there would be a considerable profit from the water, because we might pay a certain amount in extensions and in laying on the constant supply system. There would be, as we think, more profit from the gas than from the water, but we cannot say how much until we know the terms.

Mr. BROWNE: I understand from your counsel mentioning the clause with regard to profits, that there will be profits to be distributed—how will that benefit the consumers in St. Lawrence?

Witness: They will get the same reduction that we do in Ramsgate.

Mr. BROWNE: In what way? Do not half the profits go to the district rate; and so far as that half of the profits are concerned the consumers of St. Lawrence will have no benefit whatever?

Witness: They will have this benefit—if we supply the gas, they will then get their public lamps cheaper, and we shall manage all these affairs.

Mr. BROWNE: I am not speaking of the concerns of the company, but only of the profits. With regard to that half of the profits which goes to the district rate, I take it that the consumers in St. Lawrence will have no benefit whatever.

Witness: Excuse me; that is just where I differ from you, because it depends upon how you conduct the concern as to what profits you get out of it. The district rate at present only applies to Ramsgate, but we are going to incorporate St. Lawrence; but, even if it is not incorporated, we shall manage more economically than the company, by making gas cheaper, and shall make them a present of the directors fees and other things. There is another point with regard to the way in which St. Lawrence is benefited—viz., that if there is a profit the first year, we are bound to give half of it to the district rate, and half to the reduction in price; and the next year there will not be so much profit. If our Bill passes, there is a clause by which we must lower the price to the consumers. The most expensive part of the whole district, so far as regards the gas, will be in St. Lawrence; we shall lay new mains there by which, again, they will be benefited. The principal complaint of want of lighting comes from St. Lawrence. Regarding the quality of the water, I do not accept its being so good as the analysis given last year showed. It is a great deal too hard, and there ought to be some softening process; and I think that sooner or later it will be a very objectionable source of supply. I believe the company have lately been extending their adits in order to obtain more water; but that will never do for the town, because they do not propose to go anywhere else. If we required a million gallons a day, it does not necessarily follow that we must make a new reservoir, but that is a question for the engineers. If a constant supply is to be given, the fittings must be altered, whether it is done by the company or the local board.

Mr. O'HARA said he did not see where all those points were raised in his friend's petition.

Mr. BROWNE said he was attempting to show that many burdens would be thrown upon the ratepayers of St. Lawrence, which would not be the case if the works remained in the hands of the company. (To witness:) Have you looked at section 52 of the Public Health Act?

Mr. O'HARA objected to the question.

The REFEREE said there was no allusion in the petition to the power given to the local board under the Public Health Act, and, therefore, it would be as well to avoid any examination on that point.

Cross-examined by Mr. MICHAEL: I think the existing debt of Ramsgate is about £30,000, for which we have issued mortgages on the rates, some at 4¼, some at 4½, and some at 5 per cent. I do not know what the debentures now sell at, nor am I aware that one for £1000 has been put up to auction several times. We always pay the interest every time it is due. If the companies do not like the securities we offer, they can have 25 years purchase down in cash instead, which would amount to £117,000, but a great many of the (especially lady) shareholders, and so on, would rather have the security of the local board. By our Bill we propose to obtain the works either by agreement or by arbitration. We made a certain offer, which was declined, and I pledged myself to say before the committee that if they did not think the terms proper, we would accept any terms they chose to put upon us; or if they did not take the matter into their own hands, and if our Bill was passed, not for agreement but for arbitration, then it would go to arbitration. I have no doubt that an intimation from the committee would make the companies agree with us. I have never informed the people of Ramsgate that in case of an arbitration, if the result were not satisfactory, we should repudiate the award. At a meeting on Dec. 2, 1876, I said the terms of arbitration differed, but that which would be binding upon one party to the arbitration would be binding upon the other. If, however, the result of the arbitration was not binding upon the directors, then it would not be binding upon the local board, whereas if it was binding upon the directors it would be binding upon the local board. I should say we could borrow the sum of £117,000 at 4 per cent. without any difficulty. Before we offered that amount, we took more trouble to find out what we thought would be accepted, than to find out the actual value of the works.

Mr. MICHAEL: Do you believe that the money which is alleged to have been expended by the company upon the works has really been expended?

Witness: I believe that the company have expended a certain amount upon their works—of course, more than the £16,000, because it would be absurd to think that gas-works could be built for £8000 in Ramsgate, and £8000 in Margate.

Mr. MICHAEL: Have you any reason to doubt that Mr. Curling's figures last year were correct?

Witness: I do not doubt that the money was expended, but I say that it was expended within the last few years, and I should be more satisfied if an accountant examined those figures.

Mr. MICHAEL: You shall be gratified. Do you wish the committee to understand that it is the original capital invested by the company which has been earning the profits?

Witness: No; it is that *plus* what they have taken from the consumers pockets.

Mr. MICHAEL: Will you point out what is the difference between the shareholders taking the whole profit as a dividend, if they had chosen to do so, and putting the money they had earned as profit into the concern as capital to carry it on, and then doing as they have done?

Witness: There is this difference, that they were doing an illegal act; they ought to have applied to Parliament to borrow more money.

Mr. MICHAEL: Does it make any difference to the consumer whether the company first put the profits into their pocket, and then find more capital, or whether they take the profits and invest them?

Witness: It makes this difference, that in the one case they have actually first asked us to give the money out of our pockets for the capital to carry on the necessary extension of the works, and then they calmly come and ask us to pay interest thereon.

Mr. MICHAEL: Supposing that in ten years the company earned £25,000, and had no great exigency for increased works, I suppose you will admit that they might have divided the whole amount of those profits?

Witness: I say advisedly that they dared not do so, because they would have called forth indignation against them for dividing so large a profit, and we should have forced them to Parliament earlier. They, however, took care to let it go abroad that they were only dividing 10 per cent.; but that was to deceive the public.

Mr. MICHAEL: Supposing that they had earned £25,000, and, instead of dividing the whole, they had chosen only to divide £5000, and put £20,000 into the works instead of calling up more capital, what difference does it make to you as a consumer?

Witness: It makes this difference, that if they had taken it in the shape of dividends, they would then have been forced to Parliament sooner, and so we should have had restrictions placed upon them. I object to the companies Bills before the committee, because, judging from the previous action of the companies in withdrawing their Bills last year, I hold that they would certainly do the same again this year, unless we had a Bill to force them on. Our strongest ground this year is one of finance. Last year we did not have that before us; and, moreover, one of the great objections of that Bill was that we were dividing the two halves of the Isle of Thanet—taking Margate, and taking Ramsgate.

Mr. MICHAEL: You say your Bill is founded principally on finance; I want you to show the committee if there is a grievance, and I ask you whether these works could have been conducted without a large amount of capital being invested?

Witness: Yes; but the difference is that we have provided the capital instead of the shareholders providing it.

Mr. MICHAEL: What difference can it make, if you keep under the maximum of 10 per cent., whether it comes out of one pocket or out of the other?

Witness: I might go on that principle and steal a leg of mutton, and then, when I am caught, say, "I will pay you the money; it does not matter."

Mr. MICHAEL: I am sorry you apply "stealing" to the gas company.

Witness: Well, in a certain sense.

The COMMITTEE: The consumers were injured before the time the £8000 were taken from the profits and added to the £16,000.

Witness: Just because, at that period, Parliament said they were to provide works of a certain monetary value, and if that capital were insufficient, they were to provide other; but they did not provide the works as contemplated by Parliament.

Mr. MICHAEL: How much money ought to be expended in order to produce gas? What is the amount you say would be the total cost per annum?

Witness: According to the present Bill £8820. I make that up as follows:—Original capital, £24,000, at 10 per cent., £2400; capitalized profits, £48,000, 6 per cent., £2880. That makes £5280; and I add besides what the company asked for, £32,000 at 7 per cent.

Mr. MICHAEL: Suppose £32,000 were granted, that is to be expended in the future?

Witness: Companies do not care how it is spent, because the sooner it is expended the sooner they get their dividends, and that is one of the reasons why we object to the company. I should think the profits of the two towns together are very nearly sufficient to pay the 7 per cent. on the £32,000, or they very soon will be.

Mr. MICHAEL: Your supposition is based on the idea that £32,000 will be spent by the company contrary to law, on works that are not required?

Witness: I do not say that, but I say it is to the advantage of companies to spend their capital because they get their returns in the shape of dividends. The company have asked for £32,000, but I should say in the hands of the local board £20,000 would go as far, on account of economical management. If the company spend £5000 on a Bill in Parliament, that, of course, is not remunerative to them, but they will apply to raise capital for that, and get 7 per cent. on it.

Mr. MICHAEL: Your experience of companies has been rather unfortunate as to their morality. With respect to the water, and the charges that are made, are you going to charge extra for every water-closet and every bath?

Witness: As our maximum charge we may do so, and so may you. I am aware that you propose to give a constant supply, but I suppose you mean if you obtain your Bill with the money clauses. The company would never have offered to give a constant supply unless they had been forced.

Mr. MICHAEL: Never mind that; if we come under parliamentary obligations we must fulfil them?

Witness: You have not fulfilled them in former times, and therefore we say if it will suit your purpose you will do so again.

Re-examined by Mr. O'HARA: I am aware that, supposing the Gas-Works Clauses Act, 1847, had been in force in Ramsgate, the profits above 10 per cent. would have been applied to the purpose of cheapening the gas to the consumers.

Mr. O'HARA: Then, as a matter of fact, instead of allowing the profits to go to cheapen the cost to the consumer, they added to the capital, and then they earned a dividend upon that money which ought to have gone into the pockets of the consumer?

Witness: That is our great ground of complaint. They were dividing 15 per cent., and the capital they subscribed they put by. They were making 36 per cent. upon the money they had invested. In the district of St. Lawrence there are a large number of persons besides those who have petitioned against the Bill. We are proposing to borrow money on the security of the Ramsgate rates, and if the concern does not turn out a success, Ramsgate will bear the loss, and St. Lawrence will not.

Mr. O'HARA: Therefore you think it fair, when they enter into this partnership with you, and you find the money and bear the liability to loss, that they should have half the profits with you?

Witness: Quite so.

By the COMMITTEE: I tested the gas in a rough way last November, and found it bad; there was a great deal of ammonia. I tested it for sulphuretted hydrogen, but did not discover it to any great extent, even though I got the headache, and had to put out the gas.

Mr. *E. J. Hobbs*, examined by Mr. O'HARA.

I have been a draper and agent in King Street, Ramsgate, for over 20 years. I have had a general cause to complain of the gas supply, and have written letters on the subject. It is better now than it was. In 1874 a meeting was held at which a resolution was proposed expressing an opinion that gas ought to be supplied at 3s. instead of 5s., which resolution was forwarded to the directors of the gas company, asking whether they would be willing to sell the works to the local authorities, and upon what terms. In reply, the directors stated that they had no power to sell without the consent of the shareholders of the company. Another meeting was then held, and a resolution passed asking the directors to convene a meeting of the gas shareholders, in order to ascertain from them whether they would sell the gas-works to the local authorities. The answer of the gas company was that "they decline to call a meeting of the shareholders at the request of a few consumers who are desirous that the gas-works should be transferred to the local board, which body, so far as the directors know,

have neither the power nor the will to purchase." Another meeting was subsequently held, at which it was resolved to endeavour to send to the local board, at the next election, men favourable to the cheapening and improvement of the gas supply. At the next election, eleven commissioners, I believe, were returned, all, with one exception, being in favour of the scheme.

Cross-examined by Mr. POPE: I had an interview with the mayor of Margate on the subject, and there is a very strong opinion in that town in favour of the proposal.

Mr. *J. H. Hodgson*, examined by Mr. O'HARA.

I am postmaster at Ramsgate, and have been a resident there for 35 years. I am a large consumer of gas, which, in my opinion, is not so good as it ought to be, especially after eleven at night. I had to complain last year of the pressure at four o'clock in the afternoon. I have a gas-stove in my establishment, and have found during the summer months that early in the morning there was not a sufficient pressure of gas, and I had to discontinue it in consequence. For many years I have been of opinion that the price has been excessive, and that opinion is generally shared in by my townsmen. I consider it desirable that the works should be in the hands of the local board, and have advocated the transfer for some time. So far as my experience goes, the water supply is not deficient at the present time, but in years past I have found very great difficulties. I think a constant supply very desirable, but I have never applied to the company on the subject. I am a director of the Isle of Thanet Steam Flour-Mills Company, who used to take water from the water company; but it had to be discontinued because there was not a sufficient supply, and we were compelled to sink a well. I consider the rates of the water company excessive; since last year, my own rate has been increased 12s. a year.

Cross-examined by Mr. POPE: I expect the local board will manage the gas-works better than the gas company. The stove I used was an ordinary gas cooking-stove, and it was wanted about seven or eight o'clock in the morning. I believe gas might be made and sold in Ramsgate for 3s. per 1000 cubic feet, and the very fact of the large profits the company have made proves this. My complaint about the water is, that it is not on for a sufficient time, and that the price is excessive. I think the local board will derive great advantage from having control of the water in a sanitary point of view, for the purpose of flushing sewers, and so on. I also think the mode of levying the rate at present is bad.

Mr. POPE: You heard me last year pledge the companies to apply to Parliament this year, in order to put themselves under parliamentary control, and allow the local board to suggest any amendments they might desire, and, notwithstanding that, you have again proceeded with your Bill for compulsory purchase. Tell me what new facts have arisen, since the decision of the committee last year, to justify you in coming?

Witness: I am not aware that there are any new circumstances; but I have a strong conviction that the management of the gas and water ought to be in the hands of the local authorities.

Captain *T. Paris*, examined by Mr. O'HARA.

I reside in Cambridge Terrace, West Cliff, Ramsgate, and have about 30 burners in my house, and also a gas-stove. I find that the pressure is not enough, especially after the town is lighted up. We cannot get a sufficiently bold light. I am decidedly in favour of a transfer to the local board.

Cross-examined by Mr. POPE: Being a private individual, I did not think it any use to complain about the gas. I have complained to the water company, but I never find much use in writing letters. I think the local board would supply the town with gas much better, because they would appoint a proper person to look after it, and, if he did not do it, there would very soon be a town meeting. With regard to my water complaints, there is not a house in Ramsgate, of the same sort, so good as my own, as regards cisterns. On one occasion, when I was not at home, the inspector called, and reported that the ball-valve had stuck, but it was not true. The inspector sent me a notice that it was the fault of the company, and that it should be removed. That was in September, 1876.

Mr. *L. Brice*, examined by Sir E. BECKETT.

I have lived at Ramsgate for a long time, and have 26 burners in my house. Since the agitation began the gas has been pretty good, but before that it was so decidedly bad that I discontinued the use of it for about six months, to the considerable annoyance of the household. I judged of the impurity by the effect upon the pictures and the gilding of the frames, the darkening of the ceilings, and altogether the very different effect produced from what I had been accustomed to in London. At a *conversazione* of the Ramsgate Scientific Association, I was struck with the foul appearance of the flame, and I put a colza lamp on the table, a piece of paper was held up, the gas-flame being here [pointing to its position on the table] and the colza lamp on the other side, and the entire shadow and form of that gas-flame, to the great surprise of every person present, was thrown upon the paper palpably and visibly. That was about two years since. I now only use two burners—one in the kitchen and one in the hall—at considerable inconvenience. With regard to the water supply, a person of my class does not suffer from insufficient cistern storeage, but the poorer classes, where the landlord does not put sufficient accommodation, must necessarily suffer.

Captain *Flower*, examined by Mr. BIDDER.

I reside at Ramsgate, and am the sanitary engineer of the Lea Conservancy Board. As far as my house is concerned, I do not find the water supply insufficient, but I have to depend upon cistern power. I have two cisterns, but I do not get the upper one filled, except very occasionally. Two years ago I complained to the water company, and they allowed the water to remain on longer, and then my upper cistern was filled, but that was only a temporary alleviation.

Cross-examined by Mr. MICHAEL: I live at the very highest part of the town, and I do not know that the water company have established a forcing apparatus for the purpose of supplying my house. I am aware that the company have a Bill before Parliament to give a supply over the whole system, and if it provides me with sufficient water I should not object to it.

Mr. *S. Woodman*, examined by Mr. BIDDER.

I am a surgeon, residing at West Cliff, which is in the parish of Ramsgate. I have been in practice there for 13 years, and am well acquainted with its sanitary condition. In my opinion, Ramsgate has not an adequate supply of water at the present time, nor has it ever had since I have known it. I have studied the evidence given by the water company last session, which showed that they pumped an amount of water in the month of August totally inadequate for the efficient supply of the population. The supply was only about 8½ gallons per head per day, including no allowance for animals, shipping, railway supply, flushing the sewers, watering the streets, or for use at fires, and so on. It is almost impossible to have a perfect sanitary system under such conditions. The consequence of an insufficiency of supply falls chiefly upon the poorer classes, and next to them upon the larger lodging-houses, in the season. The requirements of the town cannot be secured unless there is a constant supply, and we also want the power to see that that supply is properly carried out. Last year there was an epidemic of scarlet fever, and many complaints were made of the inadequate water supply. In a place called Ratcliff Square there are 19 houses and only two cisterns, one of which was empty. When I visited the place, I found that in two of the houses the taps could not be turned off, and therefore as long as the water was on it was running to waste, and yet there was none for any useful purpose. Recently, a stand-pipe has been put up in the square, because it was found the poor people could not drink the water. In the summer time it was full of red worms and other abominations, the cisterns being exposed to the air and the sun. Many houses in the town are in an unhealthy condition, because the water supply is not sufficient. Not many days ago, I attended a woman in her confinement, and at seven in the evening there was not a drop of cold water in the house, and they were obliged to send to the neighbours to fetch it. In Queen Square, about a fortnight ago, I found a foul closet, and on asking the reason I was told that if they used water frequently the cistern would be empty, and therefore they were instructed to use it only once a day, when the water was on. The water company have been asked over and over again to give a better supply, but I do not know that they have been asked to give a constant supply till this year. I certainly think the supply ought not to be less than 20 gallons per head, which is not at all an exaggerated estimate.

Mr. BIDDER: Does it occur to you that if at the present time they are not able to keep on the supply for more than an hour a day, a Bill in Parliament cannot enable them to supply for 24 hours without getting further means of obtaining water?

Witness: Certainly. It is obvious, from experience, that the present establishment is not adequate for a constant supply, and no provision is made in the Bill for increasing the means of supply. There is very little rainfall in the summer, and the roads get very dry, and require a large quantity of water. The water is extremely hard, and analysis shows it to contain a great deal of nitrate of lime. That portion which comes from Southwood is very brackish, especially when the demands on the company are the greatest. Apart from the sanitary question, I consider there are financial reasons sufficient to justify the application for the water supply to be in the hands of the local board. I find that the average capital of the water company has been £11,350, and the average profit £1359, being a dividend of more than 11 per cent. In order to give a constant supply, they desire to increase their capital from £14,000, which is all that has been really paid, to the large amount of £50,000, and their income from £1500 to £4325, with a possible addition of £670 on mortgage income. I believe the local board could secure greater benefit at a much cheaper cost.

Cross-examined by Mr. MICHAEL: Ramsgate is one of the healthiest towns in the kingdom, and very free from epidemic diseases. I think people suffer from the badness of the water a great deal, but more from its contamination in cisterns. The condition they are in is almost inevitable from the intermittent supply. One of the primary objects of the constant supply system is to keep the water-closet cistern distinct from that for domestic supply. The nitrate of lime contained in the water is an injurious element, as it produces diarrhœa.

Mr. MICHAEL: Is it not your duty to see there is a proper supply to all the poor houses?

Witness: We wish to see it, but we have not all the powers we ought to have.

Mr. MICHAEL: How many inspectors do you think would be necessary to visit the fittings of the whole of the consumers of Ramsgate?

Witness: We wish to have one inspector, and if he was not enough, then two, three, or four. They would not be required to visit each house every day to see that the fittings were kept properly. If the water were kept on constantly, people would not be able to stand a constant dripping, and any defects would soon be remedied.

Mr. MICHAEL: Are you aware that the very fittings of which you complain were put up by the local board themselves?

Witness: I do not complain of the cisterns, but of their being empty, and that is not for the local board. The 20 gallons per head a day I mentioned is calculated upon the largest amount required in August.

Mr. MICHAEL: They must then increase their works?

Witness: That is an engineer's question. We should increase them if necessary. We think a great deal more can be obtained from the present source of supply; but if that is not the case, we could go outside our district, to Minster, where there is a good supply. I am not aware that the company are extending their supply by driving adits.

Re-examined by Sir E. BECKETT: If we had a constant supply, I have no doubt that the death-rate would be even lower than it is. We should not have so much illness, which is of great importance, even compared with the death-rate.

Mr. MICHAEL: The mortality among the inhabitants was 13·7 per 1000. Is not that the lowest in the United Kingdom?

Witness: That does not include visitors, and it is visitors who suffer most from impure water.

By the COMMITTEE: I do not know anything about the source of the nitrate of lime, but one is always afraid lest the neighbouring cesspools should manage to empty their contents into the water. The adits are only about 104 feet deep. The supply of water should, more or less, meet the wants of the maximum of the population. Minster is within the water limits of the board. The supply from there would be from the same chalk rock from which it is obtained now, but further in the country.

(To be continued.)

Legal Intelligence.

YORKSHIRE (WEST RIDING) SPRING ASSIZES.

LEEDS, TUESDAY, MARCH 20.

(*Before Lord Chief Justice* COLERIDGE.)

REGINA *v.* THE COLNE VALLEY GAS COMPANY.

This was an indictment against the defendants, an unincorporated gas company, for breaking up the highways at Longwood, near Huddersfield, for the purpose of laying down mains.

Mr. DIGBY SEYMOUR, Q.C., Mr. CAVE, Q.C., and Mr. SHAW, appeared for the plaintiffs, the Longwood Gas Company; Mr. WILLS, Q.C., Mr. WADDY, Q.C., and Mr. FORBES for the defendants.

Mr. SEYMOUR, in stating the case, said it was an indictment preferred by the Longwood Gas Company, who had been formed under the Joint-Stock Companies Act, and incorporated by a special Act of Parliament, against the defendants, who were the Colne Valley Gas Company, who were also incorporated under the Joint-Stock Companies Act, but had not obtained any special Act of Parliament. The plaintiffs charged the defendants with breaking, at various times, certain public highways and streets in the valley of the Colne, and interfering with them in such a way as made them guilty of nuisance in illegally interfering and obstructing a highway. The Longwood Gas Company were formed for the purpose of supplying gas to the mills and private houses in the valley of the Colne, Longwood, Golcar, and other places in the neighbourhood of Huddersfield. The company were established in the first instance under the Joint-Stock Companies Act, but in order to acquire the powers given by the Gas-Works

Clauses Consolidation Act, of opening up streets and laying down mains, an Act of Parliament was applied for in 1874. The maximum price of gas was fixed at 6s., and this was objected to at the time by an association of millowners. The chairman of the committee in the House of Lords suggested a compromise should be effected. The company agreed to reduce their maximum to 5s., but this was not acquiesced in, and the opposition continued. Notwithstanding this opposition, the preamble was proved, and the Longwood Gas Act came into force. In 1876 the price of gas was reduced from 4s. 6d. to 4s. generally, but in the district of Lindley-cum-Quarmby it was reduced to 3s., owing to the fact that the company there came into competition with the Huddersfield Corporation. Many of the millowners of the outlying district wished the rate to be made uniform, but to supply the outlying and widely-scattered districts upon the same terms as the thickly-populated Quarmby would be utterly hopeless. Owing to the various oppositions, the Millowners Association formed the Colne Valley Gas Company, under the Joint-Stock Companies Act, and in 1876 they gave notice of their intention of applying for an Act of Parliament, in order to obtain the same powers as the Longwood Gas Company possessed, under the Gas-Works Clauses Act. Their Bill, however, was thrown out in the House of Commons; but still, in spite of that, the company had proceeded to lay down their mains, as if they possessed powers under the Gas-Works Clauses Act. The first time that a formal decision was given in a court of law upon the question whether the powers under the Joint-Stock Act enabled a gas company to interfere with the highway for the purpose of laying down mains, was in a case where proceedings were taken against a private gas company in Sheffield, at York Assizes, in 1853. Justice Cresswell then laid it down most distinctly that a company, without the express powers or authority of Parliament, had no right to interfere with the highways; and that by so doing a nuisance was committed, for which the company were liable to indictment. This decision was upheld on appeal.

The following evidence was then called:—

William Rodgers, examined by Mr. CAVE, said he was a police-constable at Linthwaite. On June 22, 1876, he was on duty in Birks Lane, near the Grove Mill. He saw Wilson Townend and another man digging a trench; Mr. Midgley, manager of the Colne Valley Gas Company, was directing them. The trench was about three yards long, and about half a yard deep. He first saw them about half-past seven at night, and when he returned at three o'clock in the morning they were filling up the trench.

Mr. WILLS said in this case the defendants had the authority of the local board to do what they had done, and it was done by permission and agreement. His learned friend had been arguing that they could not possibly do this without committing an indictable offence.

His LORDSHIP: And you say they can.

Mr. WILLS: It is a question for the jury. We had in each case the permission of the local board to do what we have done.

Examination continued: Witness said, on June 30 he was on duty in Grove Street, when he saw Charles Winterbottom, Wilson Townend, and two other men digging in the highway near Grove Mill. They made a trench from Mr. Shaw's country house to the Colne Valley Gas Company's mains. That trench was about three yards long, but was not quite so deep as the other. When he came back about two o'clock in the morning he saw the same men laying a pipe from Mr. Shaw's country house to the main. The road was about 8 yards wide at that point. On Friday, Oct. 6, he received a message to go to Milnsbridge, and got there about half-past six in the morning. He found some one digging a trench in the highway, nearly opposite Mr. E. T. Sykes's mill. He saw Charles Winterbottom, Wilson Townend, and Henry Holmes there. Mr. Midgley was working in the trench at the time. A number of workpeople from the mill were formed in a ring round the trench. The earth which was taken out of the trench was put on one side. The crowd increased, and ultimately there were about 2000 people there. They were stood in a ring in order to prevent the men in the employ of the Longwood Gas Company interfering. Mr. Garside, on behalf of the prosecutors, was going to fill up the trench. He saw Mr. Heaton, one of the defendants, there.

His LORDSHIP: How are these 2000 people connected with it?

Mr. CAVE: They are not indicted, my lord. These men were the directors men.

Witness said Mr. Richard Heaton was pushing among the crowd, and he heard him say to the crowd, "Keep the Longwood men back." He saw Mr. E. T. Sykes there. This ended about twelve or one o'clock, when the people went away.

Sergeant *Ramsden*, examined by Mr. SEYMOUR, said he went to the place about a quarter past five in the morning of Oct. 6. He noticed that the earth was thrown out of the trench. The road was blocked, with the exception of about 7 feet. The trench would be about 6 feet broad, and was about 6 feet long, a large quantity of earth being placed at the end. It was sufficient to obstruct the traffic.

Cross-examined by Mr. WILLS: The greatest obstruction would be about ten o'clock in the morning. At seven o'clock he had to clear the people away. It was something like clearing a racecourse. At five o'clock there were two sets of people—the Longwood and the Colne Valley people. One was shovelling out and the other shovelling in, and they continued to do this very good humouredly until about six o'clock. They threw the earth out as far as they could, to prevent the other people from throwing it back again, so that the whole of the road was covered.

Re-examined: I do not think Garside was there at eleven o'clock.

His LORDSHIP: Did it last very long?

Witness: I arrived at five a.m., and the trench was completed about half-past twelve. I believe it commenced at four o'clock.

Mr. SEYMOUR: We can give many instances if necessary.

His LORDSHIP: It is proved abundantly, but I suppose the public are coming in large numbers to say they were inconvenienced.

Mr. SEYMOUR: All I can say is, I can prove they began at Grove Mill on June 23, 1876, and continued down to Sept. 11, opening trenches in the public highway.

His LORDSHIP: I suppose your 2000 people are the best obstruction you have got. You will not strengthen that case; that is a good obstruction.

Mr. SEYMOUR: I do not think my case requires that.

His LORDSHIP: I do not say whether it does or does not; but there it is. The first witness gave enough evidence to go to a jury—that the manager of the Colne Valley Company was there directing.

Mr. WILLS: There is no evidence against Shaw.

His LORDSHIP: We have got Heaton, Midgley——

Mr. WILLS: Heaton will say he was only keeping the people back.

His LORDSHIP: He was acting.

Mr. WILLS: He may have been on the other side.

His LORDSHIP: I do not think he was helping the Longwood people.

Mr. WILLS: There is no evidence against Dyson or Shaw.

His LORDSHIP: Midgley, Winterbottom, Heaton, and Holmes are certainly all proved to have been acting.

Mr. WADDY: Holmes is dead, my lord.

This being the case for the prosecution,

Mr. WILLS addressed the jury for the defendants, complaining that the action of the plaintiffs was iniquitous and unprincipled in bringing criminal proceedings against the defendants for doing exactly what they themselves had done for fourteen years. He hoped that the jury would show their appreciation of the conduct of the plaintiffs by saying that there had been no substantial obstruction, or at any rate sufficient to cause a nuisance. The learned counsel quoted the cases of *The Edgware Highway Board v. The Harrow Gas Company*, *Reg. v. Russell*, *Rex. v. Tindall*, &c.

His LORDSHIP remarked that the learned counsel had not got rid of the case, *Reg. v. Longton Gas Company*.

Mr. WILLS: The essential difference between that case and this is, that there the verdict was subject to the opinion of the Court on the case.

His LORDSHIP: If I am to choose between two judgments, I must take the written judgment, as in the Longton case. Do you wish to add any facts?

Mr. WILLS: I shall add that this was done by the permission of the local board.

His LORDSHIP: I shall direct the jury on a point of law to find your people guilty, and I will give you every means I can to question that verdict; but I do not think it would be respectful in me to run counter to the written judgment of a Court to which I am bound to defer.

Mr. WILLS put in a letter from Mr. Thomas Sykes, clerk to the Golgar Local Board, giving the defendants permission to break into the roads in question.

His LORDSHIP: As a local board they have no right to legalize a nuisance.

Mr. SEYMOUR: I do not object to that letter being put in.

Mr. WILLS: I must either have it admitted or prove it.

Mr. SEYMOUR: If Mr. Wills says he has others, I will admit them also.

His LORDSHIP said he would take note of the letter.

Mr. WILLS, continuing his address, said the prosecutors asked the jury to say that what the defendants had done was a nuisance, a crime, and a violation of the criminal law. He could not speak of the prosecutors in any but strong terms. They had tried to bring the defendants to their terms, and when they found they did not succeed in doing that, they brought this prosecution against the defendants for doing exactly the same thing that they themselves had done ten years ago. If anybody deserved to stand in the dock it was the prosecutors. There was not one out of the 2000 people spoken of brought to say that they had suffered to the smallest extent, and it rested with the jury to say whether this wrong should be effectually perpetrated or not. Referring to the Longton case, he said there were other cases bearing upon this question, in which it was decided by eminent judges that the proper question for the jury to decide was whether the interference which had taken place with the right of passage of the public was so rare, slight, and uncertain that the defendants ought not to be made criminally responsible for it.

His LORDSHIP said he should put a question of fact to the jury, and if they answered it in the affirmative, he should then ask them to find the defendants guilty. He should ask them whether there was, in their opinion, a sensible and appreciable obstruction to the respective highways, which were, in fact, obstructed by the defendants.

Mr. SEYMOUR addressed the jury, and denied that this prosecution was brought for the purpose of crushing a rival company. The prosecutors commenced when there was no rival in the field, and expended thousands of pounds in laying down mains. They conformed to the law, and applied for an Act of Parliament, asking the law to clothe them with power to lay down their mains, and they obtained an Act of Parliament, which the defendants did not succeed in doing. If the jury found that the act of the defendants in the digging out of the trench was not a nuisance, fifty companies might come in, and there would be no end to their obstructions. Lord Bacon had laid it down that it was clearly a nuisance to dig a ditch on any highway, and generally to do any act which would make it less commodious. This was an axiom that had never been controverted to this day.

His LORDSHIP, in summing up the case to the jury, said that nobody had a right to cut up a road or street without the sanction and authority of Parliament. The present case was exactly on all fours with that of *Regina v. The Longton Gas Company*, and he asked them whether there had been any sensible and appreciable obstruction to the use of the highways by the defendants, who had no authority from Parliament to lay mains thereunder. On the other hand, he pointed out that the prosecutors had parliamentary authority to lay down their mains. There could be no doubt of two things, both of which were essential, before they could find the defendants guilty. He did not like, in a case of this kind, to make any question of what he was sure none of them made any question about. The first was that there was evidence that those things were done by the authority of the defendant company. It was proved that their manager was present, at least on one occasion, and was directing the proceedings. There was clear evidence against him, but there was no evidence against Dyson, Fielding, Shaw, Hanson, Brooke, Taylor, and Lunn, and therefore he advised the jury to acquit these persons.

The jury almost immediately returned a verdict of "Guilty" against the defendants.

His LORDSHIP (addressing the counsel for the plaintiff): You do not wish me to give judgment for more than 1s., I suppose?

Mr. SEYMOUR said they would like his lordship to give a judgment which would have a moral effect. He had seen instances, in cases like these, where judgment was passed, but not enforced.

His LORDSHIP took it for granted that, after judgment, the defendants would consider themselves bound by it.

Mr. SEYMOUR observed that the defendants might still go on, and the plaintiffs wished to protect themselves.

His LORDSHIP said he would respite judgment. He would not give judgment now; and, in the meantime, some arrangement or understanding might be arrived at.

Mr. WILLS said that he, of course, represented a company, a body of directors, and, as none of them were in Court, he could not make any definite promise on their behalf.

His LORDSHIP repeated that he would reserve judgment.

QUALITY OF THE NEWCASTLE-ON-TYNE GAS.—Mr. John Pattinson reports as the results of his examinations for the month of March of the quality of the gas supplied to the borough by the Newcastle-upon-Tyne and Gateshead Gas Company:—

Date.	Illuminating Power in Sperm Candles.	Grains of Sulphur in 100 Cubic Feet of Gas.	Sulphuretted Hydrogen.
March 2	14·2	6·41	Nil.
„ 6	14·5	7·41	Trace.
„ 9	14·5	6·40	Nil.
„ 13	15·0	6·50	„
„ 16	14·2	7·40	„
„ 20	14·2	7·14	„
„ 23	14·4	6·97	„
„ 27	14·2	7·03	„
„ 30	14·3	8·38	„

A Sugg-Letheby standard Argand burner is used in testing. According to Act of Parliament, the gas should not be of less than 14 standard candles illuminating power, nor contain more than 17 grains of sulphur per 100 cubic feet of gas.

ACCOUNTS OF THE METROPOLITAN WATER COMPANIES, FOR THE YEAR 1875-6.

(The Accounts of the First Five Companies are for the Year ending March, 1876; the Last Three, December, 1875.)

Statement of Share and Loan Capital, and Expenditure on Capital Account.

Companies.	Total Share Capital authorized.	Share Capital Paid up.	Loan Capital authorized.	Mortgage and Debenture Debt.	Total Share and Loan Capital authorized.	Total Share and Loan Capital Paid up.	Premiums received on Shares Issued.	Total Expenditure on Capital Account.
	£	£	£	£	£	£	£	£
Chelsea	1,058,750	920,600	210,000	137,100	1,268,750	1,057,700	...	1,027,073
Grand Junction	1,000,000	965,415	250,000	244,700	1,250,000	1,210,115	...	1,200,312
Lambeth	1,250,000	1,046,781	248,000	210,015	1,498,000	1,256,796	6,065	1,255,826
Southwark and Vauxhall	1,518,000	1,358,000	482,000	430,581	2,000,000	1,788,581	423	1,771,166
West Middlesex	1,155,066	919,453	200,000	...	1,355,066	919,453	9,365	933,184
East London	1,400,000	1,625,560	620,000	250,000	2,020,000	1,875,560	37	1,898,087
Kent*	600,000	565,340	150,000	42,000	750,000	607,340	5,567	535,910
New River†	2,019,958	1,793,728	1,000,000	977,293	3,019,958	2,771,021	See Note.	2,792,202
Total	10,001,774	9,194,877	3,160,000	2,291,689	13,161,774	11,486,566	21,457	11,413,760

* The Kent Company's "Share Capital Paid up" is stated at £565,340, the actual receipts being £490,055.

† The New River Company's shares, as established by charter, are freehold, and are divided into moieties—one moiety, or 36 parts, being held by the incorporated "adventurers;" the other moiety, or 36 parts, being originally held by King James I., and subsequently by persons now called King's Shareholders, who are not incorporated with the adventurers. Both these moieties are again sub-divided, and held by numerous persons, and being real estate, are subject to entail and to trusts for minors. By this company's Act of 1852 the amount "expended" by the company in their works "then in existence" was declared to be £1,519,958 and upwards, and the capital of the company was deemed to be £1,519,958. This Act did not, however, create shares or a share capital, or alter or affect the nature, rights, or status of the property as existing under their charter, the rights under which charter are, by the same Act, expressly reserved. This Act authorized the taking of certain lands for special improvements in their then existing works; and the company were by that and by subsequent Acts in the years 1854 and 1857 authorized to raise on bond or debenture stock £1,000,000 for special improvements and for their "general purposes." The amount of this bond debt, as it existed on Dec. 31, 1875, is here set forth:—

Bonds at 4 per cent.	£136,700
Debenture stock at the same period, at 4 per cent.	840,593
	£977,293

By "The New River Company's Act, 1866," the company were enabled to create a new description of shares, declared to be personal estate, to the amount of £500,000, for their general purposes. The amount of these new shares, as existing on Dec. 31, 1875, is here set forth:—

442 fully paid (£100)	£44,200
4557 on call (£50) paid	227,850
	£272,050
Amount received in advance of call	1,720
	£273,770

The dividend on these new shares is to be *pari passu* with that paid to the proprietors of the original shares of the company.

Details of Expenditure and Revenue.

Companies.	Maintenance.							Management.				Total Expenditure for Maintenance and Management.	Water-Rents accrued to Date of Account.
	Reservoirs.	Distribution Works.	Pumping.	Filtration.	Salaries, &c.	Thames and Lea Conservancy, &c.	Rents, Rates, Taxes, and other Charges.	Directors and Auditors	Salaries, &c.	Collectors Commission.	Other Charges.		
	£	£	£	£	£	£	£	£	£	£	£	£	£
Chelsea	317	4,857	7,369	958	3,300	1,300	4,360	1,127	2,342	2,036	1,399	29,365	91,500
Grand Junction	334	5,645	*22,963	1,120	3,902	1,450	5,448	870	2,621	3,187	1,172	48,712	122,613
Lambeth	1,939	6,844	20,575	990	4,848	1,251	5,384	1,242	1,643	2,822	1,076	48,614	127,194
Southwark and Vauxhall	582	5,054	21,198	2,843	3,852	1,305	6,854	1,086	1,510	4,780	2,750	51,814	143,328
West Middlesex	664	3,389	12,031	992	5,676	1,318	7,362	2,629	3,070	3,842	1,426	42,399	144,798
East London	3,480	7,513	13,965	2,328	9,124	3,917	17,559	2,160	2,885	5,498	3,429	71,858	179,298
Kent	203	1,714	8,508	...	2,052	...	3,946	1,573	766	2,058	675	21,495	73,400
New River	5,030	27,328	21,580	2,915	6,858	2,433	32,844	6,293	8,848	11,900	4,486	130,515	351,424
Total	12,549	62,344	128,189	12,146	39,612	12,974	83,757	16,980	23,685	36,123	16,413	444,772	1,233,555

* This item includes a sum of £10,000, an extraordinary charge for "Repairs of engines, &c."

Expenditure and Revenue per Million Gallons.

Companies.	Maintenance.					Management.			Total Expenditure per Million Gallons.	Water-rents per Million Gallons.	Average Daily Supply.
	Maintenance and Repair of Reservoirs, &c.—including Cost of Labour and Materials.	Maintenance and Repair of Mains, Pipes, &c., and Works connected with Distribution including Labour and Materials.	Pumping-Engine Charges, Coals, Labour, &c.	Filtration—including Cost of Materials and Labour.	Salaries and Wages of Engineer, &c.	Directors and Auditors.	Salaries of Secretaries and Clerks.	Collectors Commission.			
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	Gallons.
Chelsea	0 2 4	1 15 6	2 13 10	0 7 0	1 4 1	0 8 3	0 17 1	0 14 11	10 14 8	33 8 10	7,474,492
Grand Junction	0 1 8	1 8 3	5 15 0	0 5 7	0 19 6	0 4 4	0 13 1	0 15 11	12 3 10	30 13 10	10,915,400
Lambeth	0 8 2	1 8 9	4 6 6	0 4 2	1 0 5	0 5 3	0 6 11	0 11 10	10 4 4	26 14 8	13,000,742
Southwark & Vauxhall	0 1 8	0 14 9	3 1 10	0 8 3	0 11 3	0 3 2	0 4 5	0 13 11	7 11 1	20 17 10	18,744,121
West Middlesex	0 3 11	1 0 0	3 10 10	0 5 10	1 13 5	0 15 6	0 18 1	1 2 8	12 9 9	42 13 0	9,823,064
East London	0 8 1	0 17 6	1 12 6	0 5 5	1 1 3	0 5 0	0 6 9	0 12 10	8 7 4	20 17 5	23,534,144
Kent	0 1 8	0 13 10	3 8 9	...	0 16 7	0 12 9	0 6 2	0 16 8	8 13 8	29 18 2	6,780,219
New River	0 10 3	2 15 7	2 3 11	0 5 11	0 13 11	0 12 10	0 18 0	1 4 2	13 5 5	35 14 7	26,947,333
Mean	0 5 10	1 9 1	2 19 10	0 5 8	0 18 6	0 7 11	0 11 1	0 16 10	10 7 7	28 15 10	117,219,515

EXTENSION OF WISHAW GAS-WORKS.—In view of the extended consumption of gas, consequent upon the great increase of the population of Wishaw since the gas-works were established in that burgh, a variety of extensive alterations and improvements have been made upon the works during the past winter. First in order, it may be mentioned that the old condensers, which were found to be insufficient for the increased make of gas, have been removed and replaced by others of a more complete and effective character. An engine and boiler have been erected, steam power being required for driving a combined exhauster and washer—an apparatus devised and patented by Mr. Whimster, manager of the Corporation Gas-Works, Perth. The exhauster is used for drawing the gas from the hydraulic main, thereby removing the pressure from the retorts, and affording greater scope for the manufacture of gas. Until these alterations and improvements were effected there was no means of indicating the precise quantity of gas made per ton of coal; now, however, a large station-meter has been erected for this purpose, which is calculated to pass upwards of 6000 cubic feet per hour. The improvements likewise include a governor for the purpose of regulating the pressure of gas through the town. Formerly, the supply of gas was on continuously, night and day; but by means of the new arrangement the pressure can be so modified as to effect a saving of from 10 to 15 per cent. of the gas. With the view of rendering the works independent of the town's supply of water, a special pump has been sunk to a depth of 18 or 20 feet into the old coal workings underneath the site occupied by the gas-works, and thus an abundance of water has been obtained for quenching the coke and for other purposes. An experimenting-room and offices, &c., have been erected, and the purifying-shed has been raised 3 feet. The improvements, the entire cost of which is stated to be about £2500, have been carried out under the superintendence of Mr. Adams, from plans prepared by Mr. George R. Hislop, of the Paisley Corporation Gas-Works.

Miscellaneous News.

CRYSTAL PALACE DISTRICT GAS COMPANY.

The Ordinary Half-Yearly Meeting of this Company was held on Thursday, the 29th ult., at the Albion Tavern. In the absence of Professor Erasmus Wilson, the Chairman of the Company, the chair was taken by Mr. H. P. Stephenson.

The Secretary (Mr. Magnus Ohren) read the advertisement convening the meeting, and the following report was presented:—

The directors report that the general working of the company during the half year has been satisfactory.

The demands on the company for increasing supply, and the necessity of keeping the plant in the highest state of efficiency, have added considerably to the usual expenditure on works and mains renewal.

There has been a further reduction in the price of coal, but coke has not realized so high a value, in consequence of the mildness of the winter and the cheap price of coal.

The directors going out of office by rotation are Dr. Frederic Hetley and Mr. George Livesey, who, being eligible, offer themselves for re-election.

The auditor going out of office by rotation is Mr. John Gray, who, being eligible, offers himself for re-election.

The reports of the gas examiners of the parishes supplied by the company, on the illuminating power of the gas, and its freedom from sulphuretted hydrogen and ammonia, continue to be satisfactory.

As explained at the extraordinary general meeting, the company have applied to Parliament for an amendment of their Act of 1873.

The accounts annexed show the financial position of the company. The balance of profit and loss account amounts to £9887 7s. 7d. Out of this sum the directors recommend the declaration of a dividend for the half year ending the 31st of December last, as follows—viz., at the rate of 6 per cent. per annum on the preference stock, at the rate of 7 per cent. per annum on the ordinary 7 per cent. stock, and at the rate of 10 per cent. per annum on the ordinary 10 per cent. stock, all less income-tax. This will absorb £9497 0s. 7d., and leave £390 7s. to be carried forward to the profit of the succeeding half year.

Dr. REVENUE ACCOUNT, *for the Half Year ended Dec.* 31, 1876. *Cr.*

To Manufacture of gas—				By Sale of gas—		
1. Coals, including all expenses		£20,142 9 2		Michaelmas quarter—		
2. Purifying materials, wages, &c.		864 16 2		1. Private rental—		
3. Salaries of engineer and officers		529 0 0		1,492,600 cubic feet, at 3s. 7d.	£286 1 7	
4. Wages and gratuities		3,174 9 7		2,178,300 „ 3s. 10d.	390 5 10	
5. Works, machines, and retorts—				47,106,800 „ 4s. 0d.	9,421 15 1	
Maintenance of, repairs, & labour	£4,096 9 4			2. Public rental and under contracts	1,720 12 8	
Less old material sold	24 18 10					£11,818 15 2
		4,071 10 6		Christmas quarter—		
		£28,782 5 5		3. Private rental—		
Distribution of gas—				2,520,400 cubic feet, at 3s. 7d.	£451 11 9	
6. Salaries of chief inspector, inspectors, and clerks in light office		693 0 0		1,142,000 „ 3s. 10d.	218 17 8	
7. Mains and service-pipes, repairs, maintenance, renewal, and labour		1,987 16 11		108,205,700 „ 3s. 11d.	21,190 17 1	
8. Meters, repairing, renewing, and refixing		1,062 2 2		4. Public rental and under contracts	1,729 8 1	
		3,742 19 1				23,590 14 7
Public lamps—				5. Meter-rental—the half year		587 4 8
9. Lighting and repairing		582 4 8		Total rental		£35,996 14 5
Rents, rates, and taxes—				Residual products—		
10. Rents		14 13 6		6. Coke, less labour and cartage	£7,916 10 3	
11. Rates and taxes		1,377 0 4		7. Breeze „ „	179 15 0	
		1,391 13 10		8. Tar	1,620 16 11	
Management—				9. Sundries	5 0 2	
12. Directors allowances		750 0 0				9,722 2 4
13. Salaries of secretary, accountant, clerks, and messenger		477 4 4		10. Sulphate of ammonia and ammoniacal liquor, less labour, &c.		1,079 8 10
14. Collectors commission		409 7 7				
15. Stationery and printing		221 3 11				
16. General establishment charges		512 10 8				
17. Auditors		30 0 0				
		2,400 6 6				
Sundries—						
18. Law and parliamentary charges		102 9 4				
19. Bad debts		198 14 1				
21. Insurance-fund		182 10 6				
Total expenditure		£37,383 3 5		Total receipts		£46,798 5 7
Balance carried to profit and loss account		9,415 2 2				
		£46,798 5 7				

PROFIT AND LOSS ACCOUNT (Net Revenue).

1. To Balance of net profit to be carried to next account, subject to half year's dividends to the 31st of December		£9,887 7 7	1. By Balance from last account	£9,643 18 3
			Less dividend to the 30th of June	9,088 5 0
				£555 13 3
			Less directors fees, extra—voted at general meeting	250 0 0
				305 13 3
			2. Balance from revenue account, being profit for the half year	9,415 2 2
			3. Interest, contingent-fund, &c.	166 12 2
		£9,887 7 7		£9,887 7 7

The Chairman, in moving—"That the report of the directors and the balance-sheet confirmed by the auditors be received, adopted, and entered upon the minutes," said he could have wished that the accounts were somewhat better than they appeared to be. The reasons for their not being quite so good as they could wish were, firstly, that the coke, owing to the low price of coal and the mild winter, had not realized anything like that which it usually did; and, again, their works and mains renewal accounts were somewhat exceptionally larger than they were generally. They had to enlarge some of the mains in the district, and the expense had fallen somewhat heavily upon a half year in which they were, to a certain extent, suffering from a reduction of 2d. per 1000 feet, compared with the corresponding half year. In the rearrangement of some of their work, additional duty had fallen on the secretary's department, and he should have to propose a resolution, recommended by the directors, that the salary of the secretary be increased by £100 per annum. He was sure they would agree in granting that increase to an old and faithful officer.

Mr. Linging seconded the resolution, which was agreed to.

The Chairman moved—"That a dividend for the half year ending the 31st of December last be declared, as follows—viz., at the rate of 6 per cent. per annum on the preference stock, at the rate of 7 per cent. per annum on the ordinary 7 per cent. stock, and at the rate of 10 per cent. per annum on the ordinary 10 per cent. stock, all less income-tax, be made payable forthwith."

Mr. Livesey seconded the resolution, which was agreed to.

Mr. Glaisher moved—"That Dr. Frederick Hetley be re-elected a director of this company," and the resolution was agreed to.

Mr. Newton proposed the re-election of Mr. George Livesey as a director. All gentlemen who knew anything of the gas world must be quite aware of the qualifications Mr. Livesey possessed for any office he might fill in a gas company.

The resolution was seconded by Mr. D. W. Ogg, and agreed to.

Mr. Livesey returned thanks for his re-election, and expressed his confidence in the future of the company.

Mr. Hyslop moved the re-election of Mr. Gray as auditor. The resolution was seconded by Mr. Beeton, and agreed to.

The Chairman said the next resolution was—"That the salary of the secretary be increased by £100 per annum." He need hardly point out the position Mr. Ohren had occupied in the company for the last 22 years. They all knew him, and no words of his would enhance the credit due to him for all he had done for the company. He felt sure that the proposal would meet with the cordial support of the shareholders.

Mr. Hyslop seconded the resolution, which was agreed to.

On the motion of the Chairman, a vote of thanks was passed to the auditors and officers of the company for the efficient discharge of their duties.

The Secretary briefly responded, thanking the board and shareholders for their expression of confidence, and also for the addition made to his salary.

Mr. Layton proposed a vote of thanks to the directors. He said the chairman had somewhat apologized for the accounts, and promised better things, but he might say, on behalf of the shareholders and those who burnt the gas, that if the board would do in the future what they had done in the past, they would be well satisfied. The business of the company was conducted in a manner that was very much to their credit, and to the advancement of the interests of the shareholders.

Mr. Beeton seconded the motion, which was agreed to.

The Chairman acknowledged the vote, and the proceedings terminated.

METROPOLIS GAS SUPPLY.

Poplar.—Election of a Public Analyst.—We have much pleasure in announcing that Mr. W. C. Young, F.C.S., the Gas Examiner for the Corporation of the City of London and the Metropolitan Board of Works at the Beckton testing-station, has been appointed Public Analyst for the Poplar District Board.

METROPOLIS WATER SUPPLY.

The following are the returns of the Society of Medical Officers of Health, on the composition and quality of the metropolitan waters in March, 1877:—

Names of Water Companies.	Total Solid Matter per Gallon.	Oxygen required by Organic Matter, &c.	Nitrogen— As Nitrates, &c.	Ammonia. Saline.	Ammonia. Organic.	Hardness (Clarke's Scale). Before Boiling.	Hardness (Clarke's Scale). After Boiling.
Thames Water Companies.	Grs.	Grs.	Grs.	Grs.	Grs.	Degs.	Degs.
Grand Junction	22·90	0·053	0·195	0·001	0·008	13·7	4·2
West Middlesex	21·40	0·073	0·168	0·001	0·006	14·3	4·6
Southwark and Vauxhall	20·50	0·071	0·198	0·001	0·007	14·3	4·6
Chelsea	21·20	0·054	0·165	0·000	0·008	14·3	3·0
Lambeth	22·10	0·070	0·186	0·000	0·009	13·7	4·2
Other Companies.							
Kent	30·10	0·007	0·375	0·000	0·002	18·8	4·6
New River	21·30	0·066	0·168	0·000	0·006	14·8	4·2
East London	22·50	0·070	0·150	0·000	0·006	13·7	4·2

Note.—The amount of oxygen required to oxidize the organic matter, nitrites, &c., is determined by a standard solution of permanganate of potash acting for three hours; and in the case of the metropolitan waters the quantity of organic matter is about eight times the amount of oxygen required by it.

The water was found to be clear and nearly colourless in all cases but the following, when it was slightly turbid, namely:—Grand Junction, West Middlesex, and Lambeth.

C. Meymott Tidy, M.B.

EAST LONDON WATER-WORKS COMPANY.

The following is the Report of the Directors to be presented at the Half-Yearly General Assembly of Proprietors on Thursday next:—

The accounts for the half year ending at Christmas, 1876, duly certified by the several auditors, are herewith submitted to the proprietors.

The revenue from water-rates, as there stated, amounts to £99,080 19s. 1d. The amount at Christmas, 1875, was £94,959 2s.

The costs chargeable to revenue for maintenance and management amount to £36,930 6s. 7d.; in the corresponding period for 1875 they amounted to £36,032. The parochial rates and taxes included are £1100 more in 1876 than in 1875.

The expenditure on capital account is £12,163 10s. 8d., and the balance of expenditure beyond the amount raised, as stated in the account, is £32,442 8s. 6d. This amount has now been repaid from the receipts for new capital.

The £80,000 additional debenture stock, referred to in the last report, was offered to the proprietors by circular issued on the 25th of October last, and allotted to the proprietors offering the highest premiums. The amount received in premiums was £6693 5s.

Considerable progress is making in the works at Haggar Lane, Walthamstow, and the directors hope that some portion of the works will be available during the ensuing summer for the supply of Buckhurst Hill and neighbourhood.

All the works of the company are well maintained and in good order. The directors are happy to report that no damage has been sustained from the severe floods that have prevailed during the past season, and, though slightly turbid from that cause on one or two occasions, the water has well maintained its character, as shown by the returns of the Registrar-General.

The directors are still extending the system of constant supply, and their mode of introducing this alteration by small districts has been satisfactory.

In consequence of the great changes by increase of buildings and the construction of railways, a modification of the boundary line between the New River and the East London Companies has become necessary. Negotiations for this object are in progress.

The quantity of water pumped during the half year ending at Christmas last was 4,565,611,072 gallons, being an increase of 140 millions of gallons, or about one week's consumption over the corresponding period for 1875.

The following extracts, from a report submitted to the Society of Medical Officers of Health, on the composition and character of the water supplied to London during 1876, by Charles Meymott Tidy, M.B., F.C.S., will be of interest to the proprietors:—

> I have thought it advisable to collect the samples myself every month from the various stand-pipes supplied by the several companies, without the companies having any knowledge of the day when, or time at which, the collection is made. In this way I have secured, as far as possible, a fair sample of the water for analysis.
>
> I am of opinion that my analyses prove that London enjoys a water supply of very considerable purity; and I am further convinced that, from a medical point of view, no substantial objection can be urged against its wholesomeness for dietetic and culinary purposes.

Three directors go out of office by rotation—viz., Messrs. Coope, Davis, and Barnard—but are all eligible for re-election. They have given notice, in accordance with the company's Act of Parliament.

One of your auditors, Mr. H. J. Baddeley, also goes out of office by rotation, but is eligible for re-election.

The directors recommend that a dividend of 3 per cent. for the half year on the ordinary stock, and of 2½ per cent. on the debenture stock, both clear of income-tax, be declared payable on the 10th of July next in the usual manner.

TUNBRIDGE WELLS WATER SUPPLY.

The Water-Works Committee of the Local Board have recently consulted Mr. Bateman, "to advise them on the present and prospective wants of the town, the existing means of supplying those wants, and the best mode of supplying what may be further required." Mr. Bateman's report thereon was laid before an adjourned public meeting of the inhabitants on the 21st ult. It was as follows:—

I have the pleasure of reporting the result of my examination of your water-works on Tuesday last, the 13th inst., and of the information which I received on the occasion. I was accompanied over the works by your engineer, Mr. Brentnall, and the chairman of the Water-Works Committee, and I received from the former such information upon the yield of your springs and the supply of water, as enabled me to come to definite conclusions.

I am informed that the present fixed population of Tunbridge Wells exceeds 23,000 persons, and that it is rapidly increasing. To these must be added the floating population, consisting of visitors in the summer season, and when the town is full on such occasions, the population is estimated to amount to 30,000 persons at the present time.

These visitors will probably be resident in Tunbridge Wells at periods of the year when the springs are lowest, and the demand for water is greatest.

In my opinion, the gross supply, to include street watering, garden watering, and the various public purposes to which a full supply of water is devoted, should be estimated at 25 gallons per head per day for a town like Tunbridge Wells.

This allowance on 30,000 persons would show that the present requirements, when the town is full of visitors, equal 750,000 gallons per day. Twenty gallons per head per day, with great economy on the part of the consumers, might possibly be sufficient. This will amount to 600,000 gallons per day upon the present population, without providing for future increase. The water-works have been constructed in reliance upon the quantity of water yielded by certain springs, which were supposed to be sufficient for the wants of the town when in their lowest condition, without any assistance from storeage.

Mr. Brentnall has furnished me with the gross results of the yield of the springs, and the quantity of water supplied to the town during the years 1874, 1875, and 1876. I find that in 1874 the total yield of the year averaged 785,600 gallons per day. In 1875 (which was a wet year), the total yield was equal to 886,700 gallons per day, and in 1876 the total yield was equal to 734,500 gallons per day.

If all the water thus yielded by springs were impounded when more than sufficient for the wants of the town, the average daily quantity could not safely be estimated at more than 700,000 gallons per day. In the year 1874 the springs yielded at their minimum less than in any of the three years mentioned. The quantity yielded amounted to 206,064 gallons per day, and the average volume of the springs during 189 days of drought, which occurred in that year, was but 294,563 gallons per day. During this period of drought all the water which the springs yielded was supplied to the town, and at the minimum the deficiency must have been severely felt. In the year 1876 the drought extended over a similar period. The springs fell at their lowest to 210,271 gallons per day, the average during the long drought being also little more than in the year 1874.

It is clear, upon these figures, that storeage is required, and it is also, I think, evident that even the storeage of every drop of water which the spring would yield would scarcely be sufficient for a full and satisfactory supply to the town.

To make use of all the water to which you are now entitled, and to give a barely full supply to the existing population when increased by summer visitors, would required storeage to the extent of about 80 million gallons, in addition to the average yield of the springs during the long drought.

The parliamentary plans of the Bill now before Parliament show a reservoir which, I am informed by Mr. Brentnall, will hold 41 million gallons. If it were made this size it would add about 217,000 gallons per day to the springs, giving a total supply (springs and storeage included) of about 511,000, say 500,000 gallons per day. I am informed that the ratepayers object to the outlay required for a reservoir of this size, and they have reduced it to 27 millions.

The produce of a reservoir of this size, added to the springs, will give little more than 400,000 gallons per day during a long drought, such as occurred in 1874 and 1876.

A reservoir of this capacity I consider quite insufficient for the wants of Tunbridge Wells, and I may say that even that proposed of larger capacity is, in my opinion, neither sufficient to make a full use of the water you have, nor to give a full supply to the gross population.

It would, however, enable you to give about double the quantity of water which you have hitherto been able to afford in dry seasons, and as such an addition would, no doubt, be a great boon to the inhabitants, it may with great advantage be constructed of the full size originally contemplated, and by-and-by, if it should prove as I expect, that more water is required, additional storeage may be provided.

THE CHEMISTRY OF GAS MANUFACTURE.

By A. Vernon Harcourt, Esq., F.R.S.,
One of the Metropolitan Gas Referees.

[A course of Four Cantor Lectures delivered at the Society of Arts, London.]

Second Lecture.—Monday, March 12.

The condensation, as it is called, of coal gas, consists in cooling the products of the destructive distillation of coal to the temperature of the atmosphere. A separation is thus caused between those portions which are gaseous at this temperature, which becomes the common temperature of all the intermixed gases, and at a pressure which is different for each gas, and those portions which are liquefied under these conditions. The pressure to which each gas is subjected is the atmospheric pressure, *minus* the tension of all the other gases.

This separation is not a separation of different kinds of matter one from another, but of different portions of the same kinds, each kind dividing itself between the gaseous and liquid product in a proportion depending upon its specific volatility or solubility. So completely is this the case, that, of all the substances forming the crude heated gas, there is, probably, not one which does not divide itself, however unequally, between the portion which remains gaseous and that which becomes liquid when the crude gas is cooled. Some hydrogen, to take the extreme cases, is dissolved in the liquor, and some vapour of the solid hydrocarbons, remains in the gas. One or two of the more volatile hydrocarbons, such as benzol, probably divide themselves pretty equally between the condensed liquid and the gas.

I have here a drawing of a set of gas-retorts, showing the position which the retorts occupy in the furnace. They are long boxes of fire-clay, very often made in the shape here shown—the shape of the letter D, with the straight side downwards, sometimes closed at the far end, and sometimes open at both ends. Into these the coal is put, either thrown in with a shovel, or thrust in with a scoop. Then a lid is placed over the mouth, the temperature being kept constantly at bright redness, so that for six or seven hours the coal is exposed to this degree of heat, the maintenance of which is essential to the production of a large quantity of gas. The only issue for the gases formed from the heated coal is by the ascension-pipes, which are shown in the drawing. Through them the gas passes, and thence enters this large and long pipe, into which most commonly the ends of the smaller pipes descend for a certain distance, so as to open below the level at which the condensed liquid runs off. This pipe remains full of liquid, chiefly the less volatile portions of tar, and the gas, as it is formed, bubbles through the liquid, and so goes off.

What I propose now to follow is not the permanent gas, but that which becomes liquid when the heated mixture of gases is cooled. Some of this liquid passes along the downward pipe, and forms the first portion of what is separated from the gas by condensation. The gas, however, is still quite hot when it leaves the hydraulic main, as it is termed. It passes from thence through a system of pipes so arranged as to present a large cooling surface to the gas, in order to the more complete separation from it of those parts which are liquefiable. The drawing represents an arrangement of the condensers, in which the gas ascends in one pipe and descends in the other, so that it is exposed during its course to the cooling influence of the air, the heat of the gas traversing the sides of the iron pipe, and thus an exchange of temperature between the gas and the surrounding air going on through the whole of the passage. Under these influences a further portion of liquid is condensed out of the gas, which runs down into a tank, and is collected in the well at a lower level. The liquid divides itself into two parts, a lower layer of tar, of which I gave you a short account in my last lecture, and an upper layer of water holding various substances in solution, which is commonly called gas liquor, or ammoniacal liquor, of which I have to speak to-night.

A list is placed on the wall of the substances derived from the destructive distillation of coal, and I will refer to those which are found in gas liquor. At the head of the list comes water, which is the first substance given off when coal is heated; and it is by its solvent action that many other substances are removed from the crude gas at this stage.

The compounds of hydrogen with carbon are sparingly soluble. Hence in spite of the abundance of these substances in coal gas, very little of any of them dissolves in the condensed water. The compounds of hydrogen with nitrogen and with sulphur are both soluble in water, and the substance produced by their union is soluble. Carbonic acid also dissolves in water to some extent, and abundantly in water containing ammonia. By the action of ammonia upon carbon bisulphide, ammonium sulphocyanide, another soluble salt, is formed. In some coal mines a stream of salt water has been found, and chlorine, probably existing as sodium chloride, is an element present in small quantities in the ash of coal. Like the elements already named—carbon, oxygen, nitrogen, and sulphur—chlorine escapes from the heated retort in combination with hydrogen, and this compound, or rather the product of its union with ammonia, is found in gas liquor.

Acetic acid, which is produced largely by the destructive distillation of wood, is also formed in small quantity from coal, and dissolves as ammonium acetate. The presence of sulphate of ammonia, to a small extent, may be due either to oxidation of sulphur compounds in the heated gas, or to the subsequent action of the air upon the sulphur compounds in solution. Of this latter action, the principal product is a salt, corresponding to the sodium salt used as a "fixing" agent by photographers—ammonium hyposulphite. Another secondary product of a reaction between the cyanides of the liquor and the iron of the condensing-pipes, is ammonium ferrocyanide.

I come now to the treatment of this ammoniacal liquor. It is a substance of which the value was at one time not appreciated. It used to be got rid of, and probably still is so at many gas-works, as a waste product. But, commonly, it is converted into sulphate of ammonia, either at the works or by the chemical manufacturer.

From the tank in which it is stored, it is pumped to the top of a vessel such as is called a "scrubber" in gas-works—a tower filled with coke or pebbles, or it may be an arrangement of alternate shelves, down which it trickles, exposing a large and constantly renewed surface. The liquid runs off from the bottom of this tower into a tank or boiler, and into this tank or boiler there is blown a current of steam, and there is also injected a little stream of milk of lime.

Let us consider first what passes in the tank. There the liquor, which has already lost a part of its ammonia, is strongly heated by the steam which is blown into it, and it is also exposed to the action of the lime. Lime decomposes the substances of which I was speaking just now, sometimes called the fixed salts of ammonia, substances which contain ammonia in a condition heat alone will not drive off. A mutual decomposition takes place between these salts, such as ammonium chloride and sulphate, and the lime which is in the tank, and salts of lime are formed, and ammonia is driven upwards with the steam. This steam, then, already containing ammonia, passes into the tower, and as it rises up meets a descending stream of gas liquor. The proportion between the two is such that the high temperature of the steam reaches just to the bottom of the tower, and when the liquor that comes over meets the ascending heated current, it gives off at once so much of its ammonia in a free condition, as is combined with substances which leave it still volatile. So that from the top of the tower there passes over a quantity of gas, consisting of ammonia and the volatile acids which were combined with ammonia, principally carbonic acid and sulphuretted hydrogen. These gases are conducted into a wooden tank lined with lead, which is filled with sulphuric acid, the ordinary brown oil of vitriol, and there the ammonia is condensed. It combines at once, with the production of great heat, with the sulphuric acid, and as the quantity accumulates, it crystallizes in combination with the sulphuric acid as ammonium sulphate. I have here a specimen of gas liquor before treatment, and a specimen of the salt which is formed from it. This is the white sulphate of ammonium which is got by the process I have described. The carbonic acid and the sulphuretted hydrogen are got rid of either by conducting them to the bottom of the furnace of the works, so as to destroy the sulphuretted hydrogen, or else by passing them through a purifier containing oxide of iron; or else, which is the best plan, the gases are burnt, and the products passed into lead chambers, and thus the sulphuretted hydrogen is converted immediately into sulphuric acid by the same process by which the vitriol maker converts native sulphur, or iron pyrites, into sulphuric acid.

There is a question of some importance as to the way in which the ammoniacal liquor, which is sold by the gas manufacturer to the chemical manufacturer, should be estimated. The ordinary way, I believe, of making its estimation is by mixing directly the ammoniacal liquor with sulphuric acid, and observing how much acid of a known degree of dilution must be added to a measured quantity of the liquor before it is completely neutralized. The strength of the liquor is ordinarily described by a statement of the quantity of sulphuric acid that it is capable of neutralizing, so that the expression 10-ounce liquor means that a gallon of the liquor contains ammonia enough exactly to combine with and neutralize 10 ounces by weight of sulphuric acid. The direct determination of ammonia in this way gives a very imperfect and unequal estimate of the value of the ammoniacal liquor. Imperfect, for the reason that besides free ammonia which can be directly boiled out of the ammoniacal liquor, and which alone neutralizes the sulphuric acid, the ammoniacal liquor contains also combined ammonia, which is got out of it and turned to account by the chemical manufacturer, and which is not estimated by this mode of testing. It is also an unequal mode of testing, because the proportion of free to fixed ammonia appears to vary greatly in different samples of liquor. Therefore, it must be very much better, and I have no doubt it will ultimately become the general practice, to use some means of determining the value of ammoniacal liquor more exactly. The most obvious way of doing it is by means of such an apparatus as I have here set up.

It consists of a little flask connected with a Liebig's condenser, in which the steam formed on boiling the liquid in the flask passes along a narrow tube surrounded by a larger tube, through which cold water is kept flowing. The ammonia from the liquor, and from the fixed ammoniacal salts—for I have placed in the flask besides ammoniacal liquor a small quantity of lime—passes along the inner tube. It is dissolved by the water which distils with it, and drops into the coloured liquid which has been placed beforehand in the receiver into which the tube passes. The liquid is dilute sulphuric acid, a measured quantity of an acid of known strength, coloured with a little litmus. I have taken, for convenience, 16 c.c. of ammoniacal liquor, which, before being distilled, was mixed with twice its volume of water. In the receiver I have placed 16 c.c. of the standard acid which is commonly employed—namely, the acid which contains one pound of strong sulphuric acid in one gallon of dilute. This measure of acid will be sufficient to neutralize all the ammonia that can be given off, unless the liquor is more than 16-ounce liquor. It is only necessary to carry on the distillation until about one-third of the liquid in the flask has passed over. At the outlet of the receiver is a tube with two bulbs blown upon it, which hold a little of the liquid. By turning it round, it is made to serve also as a funnel for bringing the acid into the receiver. At the end of the distillation this tube is turned round, and the liquid which is in the bulbs runs back into the body of the receiver. By substituting a solid cork for that which holds the bulb-tube, and removing the receiver with its contents, and running in standard ammonia from a burette till the litmus changes colour, the quantity of acid which has not been neutralized, and hence the quantity neutralized, and the quantity of ammonia in the volume of liquor operated upon, are known. The solution of ammonia is made of just half the strength of the acid, so that two measures of this solution will neutralize one measure of the acid. Now, supposing the liquor I am testing is exactly 16-ounce liquor, I should find, when the distillation was complete, that the litmus would just have acquired a neutral colour. But supposing the liquor is not so strong, and that 4 c.c. of standard ammonia have to be added at the end of the operation to neutralize the remaining acid, the volume of acid neutralized by the distillate is 14 c.c., and the liquor tested is 14-ounce liquor. That is a very simple and obvious way of estimating the value of a sample of liquor.

Another process which is still simpler, requiring no application of heat, and no watching, but occupying a rather longer time, can be executed with the compact apparatus which I hold in my hand.

It consists of a ground-glass plate, a small dish into which a measure of acid is put, a crucible supported on a triangle over the dish, which is charged with a measured quantity of liquor and a pinch of lime, and, lastly, a bell-glass which stands upon the glass plate, and encloses the smaller vessels.

The ammonia is not given off very quickly, so that there is no fear of any loss during the half minute required to discharge the pipette into the crucible, and place the bell-jar over it again. Ammonia is so volatile when in aqueous solution, that if we take some solution of ammonia and pour it into a flat dish, and examine it a few hours afterwards, we find it contains no ammonia at all. The ammonia escapes wholly into the air. Therefore, if we have in separate vessels, within the same enclosure, a solution of ammonia and a liquid which will combine with ammonia, and will absorb and fix it, in the course of time—and it is only a few hours that is required—the whole of the ammonia will have transferred itself to the liquid which is capable of combining with it. So that, having measured the acid into the lower vessel, and the ammoniacal liquor into the upper vessel, it only remains to let them stand through the night, and in the morning to determine, as before, with standard ammonia, the quantity of acid which remains unneutralized. The calculation is just the same as in the former case.

I come now to the question of the purification of gas from ammonia, an operation which needs to be accomplished for two reasons. The presence of ammonia in gas is undesirable, because ammonia has a prejudicial action, especially upon brasswork, and its combustion produces some of the corrosive oxides of nitrogen. But also the whole of the ammonia is very well worth collecting.

Owing to the volatility of which I was speaking just now, the condensation of the gas does not remove the ammonia completely, and it is necessary to employ some other means. That which is commonly employed is washing with water; and the most usual mode of applying water is by means of a scrubber. In this vessel the gas which still holds ammonia ascends through the material with which the scrubber is filled, which is most commonly coke, or it may be boards or other materials, and a current of water is allowed to descend through the same.

But it is not easy to secure the distribution of both gas and water over the whole of the contents of the scrubber. If we fill such a tower as is shown in the drawing with any material—say, coke—and allow a small quantity of water to run down, the water will by no means spread itself over the whole of the contents of the tower, but, on the contrary, it will find for itself a watercourse, and will follow that. This depends upon a fact which we have often occasion to observe, that solid materials are not so readily wetted by water when they are dry as when they have already been wetted. If we watch rain falling on a window-pane, we see the drops run quickly where the glass is already wet, and hang, or move slowly, where the glass is dry. Thus it happens with the coke in the scrubber; where the water has trickled and found its way, the water will continue to run, but where the surface has once got dry, that part will remain dry. But, of course, the gas chooses its route independently, and prefers those open spaces where there is no counteracting current of water descending. Therefore it may well be the case that the water which we use to take out the ammonia will follow one set of channels, and the gas will follow another. A systematic arrangement of shelves, after the manner of Coffey's still, is better than any hap-hazard arrangement, such as filling the tower with a material like coke. Besides scrubbers, there is also another class of vessels for applying water, called "washers." I shall not attempt to describe the various forms of washers which have been proposed. The principle common to them all is that the liquid is stored in a tank, and the gas is forced through a few inches of the liquid in streams of bubbles, at a multitude of different points.

I have set up here, partly in illustration, partly because I venture to think the particular form a good one for the purpose, a small washer, which I have made out of a piece of glass tubing. An obtuse double bend has been made in the tube at intervals of four inches, so that it consists of several portions which are parallel, and are now placed horizontally, connected by shorter portions, which are inclined. Two smaller tubes at each end, passing through the corks which close it, serve for the inlet and outlet of gas and water. At the upper end water enters at the rate of one drop every two or three seconds. It stands in a series of shallow pools, where the tube is horizontal, and flows in a slow stream down the inclined portions.

The gas passes first into this three-necked bottle, at the bottom of which I have placed some dilute ammonia, and thence into the lower end of the tube washer. A small jet is attached to the third neck of the bottle; and the gas, after passing through the washer, escapes by a similar jet.

I will now try whether there is any difference in the amount of ammonia in the gas as it issues from the bottle, and after it has passed through the tube. I hold over the first jet a piece of red litmus paper. It becomes blue at once where the gas impinges upon it. This shows that the gas which enters the washer contains abundance of ammonia. I now apply the same test to the gas which has passed through the washer. You see that the colour of the paper remains wholly unchanged.

The way in which my small apparatus works is by exposing each portion of the gas to successive portions of water, of which each is purer than its predecessor. The gas does not bubble through the water, but only passes over its surface, and perhaps, therefore, the apparatus does not so much resemble a washer as a Coffey's still, with its shelves spread out horizontally. I doubt whether its action could be improved by agitating the gas with each portion of the liquid successively.

According to the molecular theory of the constitution of gases, which has now attained a high degree of probability, gases are not at rest when we are not causing them to move, but are of themselves in a state of continual and rapid motion. It has been calculated that the molecules of hydrogen, at the ordinary pressure, and at the temperature of the freezing point, are moving about with an average velocity exceeding one mile a second. Now, if it is the case that gases are moving about, striking in all directions, causing a pressure, which their elasticity exhibits, by virtue of the continual impact of their molecules on the sides of the containing vessel, they also, without our using force to drive them through, must be coming—each molecule in its turn—into collision with any liquid surface with which they are in contact, or over which they pass. And, therefore, when, as in this case, the gas is not anywhere bubbling through the liquid, or forced into contact with it, but only streaming over its surface, nevertheless, as each particle of gas is, with an inconceivable rapidity, ziz-zagging backwards and forwards between the upper surface of the glass and the water, this motion produces, without requiring the application of any external force, actual contact between every part of the gas and the liquid spread out beneath it.

But what is required, in order that the purification should be complete, is that the gas should be successively exposed to fresh portions of the liquid used to purify it. This is absolutely necessary where the liquid, as in the case of a solution of ammonia in water, is one which does not fix the gas, but only reduces its tension.

When ammonia is dissolved in water, it still possesses a certain tension, according to the strength of the solution; and if we have a solution of ammonia sufficiently saturated, ammonia will remain as a gas over the surface of that solution, just as it remains as a gas over a surface of mercury; and this tension of ammonia in solution only ceases when the solution becomes indefinitely dilute. Thus, by no amount of agitation, and no length of exposure, could we wash ammonia out of another gas, with water which contains itself a small quantity of ammonia. A short time will serve; but the time must be occupied in the exposure of the gas to successive quantities of liquid—that which contains

some ammonia being removed, and other water, which does not contain any, being substituted for it. And no arrangement of washer or scrubber will accomplish anything like a perfect purification of gas from ammonia, which does not provide for a complete renewal of the washing liquid. Where that which is employed to remove the ammonia is a substance which can fix it, this condition is not necessary. For example, if I take a bottle of ammonia, and pour into it some water, and shake up the water in the bottle, and then hold a piece of litmus or turmeric paper in the bottle, to see whether the ammonia is removed, I find it is not; and if I were to prolong the shaking for a long time, still, however much the volume of water exceeded that required to dissolve the ammonia, it would never so take it out but that I should find enough in the bottle to show with test-paper that ammonia was present. But if, instead of water, I took sulphuric acid, or a solution of sulphate of iron, or any liquid which combines with ammonia to form a fixed substance, then the removal would be complete. But, using water only, the frequent and complete renewal of the water is a *sine qud non* for the success of the operation.

I have spoken of the substances which are condensed in the form of tar, as we call the mixed liquid, from gas. Now, it is a question which must have occurred to every one who has seen the process of tar distillation, how it comes to pass that substances so volatile as are the lighter distillates from coal tar, and so exceedingly valuable in respect of their illuminating power, are always being removed in the process of coal gas manufacture. I may perhaps illustrate the illuminating power and volatility of one of these substances by a simple experiment. I have here an apparatus for making hydrogen, and I have arranged a pair of tubes so that I can either pass the hydrogen directly to a burner, where it gives a very feeble light, as you see, or I can make it pass over some of this substance which has been got out of the coal gas—namely, benzol, which is the first of the substances distilled off from coal tar, and the most volatile. When the hydrogen gas is passed over the benzol, it mixes with the vapour of benzol, and the mixture of the two burns with a very luminous flame; but if I open the communication again, so as to allow the hydrogen to pass directly to the burner, there is hardly any light produced. That illustrates the volatility and illuminating power of some of the substances which are removed from coal gas. How comes it to pass that these substances are removed?

I will try to illustrate the matter by another experiment. I have here a little coal gas in a glass cylinder over water, and I have placed an india-rubber band round the cylinder, so as to mark the height the water stands. Now I will pass up through the water into the cylinder a few drops of a volatile hydrocarbon. You see at once, to some extent, and rather more when I agitate the liquid, so as to promote its diffusion, that the water falls. That happens because the substance, being very volatile, exercises a considerable tension. We have now under the same pressure, and at the same temperature, a volume of gas which is increased by about one-half. If I now take a portion, not of the same liquid, chemically speaking, but still of a liquid which was distilled from the very same sample of petroleum, differing only in being of a higher boiling point than the portion which I first passed up, what is the effect I shall produce? I shake the cylinder a little to bring the liquid last added into contact with its other contents, and the effect is, that instead of this liquid adding its portion of vapour to that which the jar already contained, on the contrary, it has produced a considerable reduction of volume, and if I were to add a little more the volume would return to about that which the coal gas occupied originally. This illustrates what happens in the condensation of the hydrocarbons produced by the destructive distillation of coal. If they were without action one upon another, we should have some little addition to the volume of the gas, and a more considerable addition to its illuminating power. But these substances are, in fact, solvents one of the other, and just as we can wash ammonia out of gas by the action of water, so the lighter of these hydrocarbons are washed out of the gas by the solvent action of those substances of the same class which have higher boiling points.

I have still a few words to say about the purification of gas from two other ingredients—carbonic acid and sulphuretted hydrogen. You know that for the removal of sulphuretted hydrogen there are two substances which are commonly employed—lime and oxide of iron. Either of these substances is perfectly good for the purpose for which it is employed, and will completely purify gas from sulphuretted hydrogen.

Oxide of iron has over lime this great advantage, that the sulphur which the gas contains, when removed by oxide of iron, appears ultimately in the uncombined state, and can be made into sulphuric acid, whereas the sulphur which is removed by lime cannot, as far as we know, be turned to any account afterwards. Another advantage of the oxide of iron is that it may be used over and over again. It is a much more costly substance than lime, and it never could be used for purification if it could be used but once. I have here a sample of it ready for work, and another in the condition in which it comes out from the purifiers after it has been used. The second sample has already lost a little of the black colour which it had when I first poured it out; and gradually, by exposure to the air, it loses that black colour entirely, and becomes of the same red colour as the other sample, which is in the condition in which it is placed in the purifier. The chemical change which is now taking place is that, by the action of the oxygen of the air, the iron, which was oxide when first put in, and which has been converted into sulphide by the action of the sulphuretted hydrogen of the gas, is being reconverted into oxide; the sulphur which had combined with it being separated in the elementary condition.

Now, although oxide of iron serves equally well with lime the purpose of removing sulphuretted hydrogen, it does not serve in any degree the purpose of removing carbonic acid. The presence of carbonic acid in gas is injurious, not to the consumer, but to the maker of gas, for it affects the illuminating power; and if this is deficient owing to the presence of carbonic acid, it has to be increased by the production of a larger proportion of illuminating gases, which must be effected by the addition of a larger dose of cannel to the coal used in making the gas. Therefore it is desirable that the carbonic acid should be removed; and either lime or some other mode of removing the carbonic acid is generally employed. To some extent the carbonic acid is removed in the operations of condensation and scrubbing, for it combines with ammonia and forms a solid substance. Both it and sulphuretted hydrogen can be removed from gas by the action of ammonia, if the ammonia can be readily obtained, and can in a suitable manner be brought to bear on the gas. The process devised by Mr. Hills, which is now in use in the South Metropolitan Gas-Works, appears to me to be an admirable process for the production of ammonia in a condition suitable for the purification of gas. This process consists in exposing gas liquor to conditions exceedingly similar to those I endeavoured to explain in describing the manufacture of sulphate of ammonia, with this difference, that the quantity of steam is less relatively to the amount of ammoniacal liquor, and therefore the temperature is not raised so high. The result of this limited heating may be explained as follows:—We may regard ammoniacal liquor as being a solution of three gases—ammonia, sulphuretted hydrogen, and carbonic acid. These three gases are unequally soluble, ammonia being very much the most soluble; sulphuretted hydrogen next in order, but much less soluble than ammonia; and carbonic acid much less soluble still. Now, gases are less soluble in proportion as the temperature of the dissolving liquid is higher, and, consequently, when by heating the water we diminish the solubility of these gases, they are given off in a proportion corresponding in inverse order to their solubility. When ammonical liquor is heated so that the escaping gases have to pass over an entering stream of cold liquor, it parts first and most readily with carbonic acid, then with sulphuretted hydrogen, and not until it is pushed much harder does it part with ammonia. By so regulating the temperature that there shall be always passing down a sufficient quantity of cold ammoniacal liquor, the heat may be kept at that point at which carbonic acid and sulphuretted hydrogen are driven out and ammonia is retained, and by carrying on this process continuously, the liquid which is drawn off contains ammonia, which is practically free from carbonic acid and sulphuretted hydrogen.

I will illustrate to you the different solubility of these gases. I have here three tubes, each of which I have filled with one of the three gases, and I will now open them under water. In the first, which is filled with carbonic acid, you see the water hardly rises at all, the gas being only sparingly soluble. In the one containing sulphuretted hydrogen, it rises rather more, and in course of time and by agitation the tube will become filled with water, the gas being wholly dissolved; but you see in both cases solution proceeds slowly. Now I will compare with them the effect on the tube filled with ammonia. The moment I remove the cork, the water shoots up to the end of the tube. That illustrates the great difference between the solubility of these gases.

I will only detain you for a few moments to show you another application of this little washer—namely, to the removal of sulphuretted hydrogen from gas by washing it with ammonia.

By the process I have described, we can obtain sufficiently pure caustic ammonia. What needs next to be done is to use this ammonia, so far as may be, for the removal of carbonic acid and sulphuretted hydrogen from the gas; for, if that can be done, we have a complete and excellent round of processes. From the ammoniacal liquor the carbonic acid and sulphuretted hydrogen are driven out by steam, and passed through a purifier containing oxide of iron. The carbonic acid escapes into the air—and it is clearly better that it should go right away into the air than that lime should be used to remove it, which has first had to be freed from its own carbonic acid by burning in a kiln. The sulphuretted hydrogen is stopped, so that no nuisance is produced, and the sulphur is not lost.

I will now illustrate the application of the ammonia so produced to the purification of gas from sulphuretted hydrogen. Here, again, I have to make my gas impure to show the test. I have placed in the three-necked bottle some ammoniacal liquor, which will no doubt yield a sufficient quantity of sulphuretted hydrogen. On testing the gas, as it leaves the bottle, by a piece of lead paper, you see the paper is blackened directly; but now I will test it at the other end, after it has passed along the bent glass tube down which the solution of ammonia is trickling. No effect is produced on the lead paper, though it furnishes a most delicate test for minute quantities of sulphuretted hydrogen. I have repeated this experiment several times; for the little washer really surprised me by its efficiency—that it should be possible thus, with ammonia dropping at this slow rate, to remove sulphuretted hydrogen from gas so completely. On trying it in this way when gas was passing through even more rapidly, not being forced into contact with the ammonia, but simply being exposed sucessively to fresh portions of the liquid, the sulphuretted hydrogen has been completely removed.

IRON AND STEEL INSTITUTE.

TUESDAY, MARCH 20.

The following is an extract from the Inaugural Address of C. W. SIEMENS, Esq., F.R.S., the president:—

Next in importance to cheap, or rather to efficacious labour in the production of iron and steel, comes cheap fuel, a subject to which, as you are aware, I have devoted considerable attention, and I would, therefore, treat it, with your permission, rather more fully than other subjects of perhaps equal importance. Fuel, in the widest acceptation of the word, may be said to comprise all potential force which we may call into requisition for effecting our purposes of heating and working the materials with which we have to deal, although in a more restricted sense it comprises only those carbonaceous matters which, in their combustion, yield the heat necessary for working our furnaces, and for raising steam in our boilers. The form of fuel which possesses the greatest interest for us, the iron smelters of Great Britain of the nineteenth century, is, without doubt, the accumulation of the solar energy of former ages, which is embodied in the form of coal, and it behoves us to inquire what are the stores of this most convenient form of fuel. Recent inquiry into the distribution of coal in this and other countries has proved that the stores of these invaluable deposits are greater than had at one time been supposed.

I have compiled a table of the coal areas and production of the globe, the figures in which are collected from various sources. It is far from being complete, but will serve us for purposes of comparison.

The Coal Areas and Annual Coal Production of the Globe.

	Area in Square Miles.		Production in 1874. Tons.
Great Britain	11,900	..	125,070,000
Germany	1,800	..	46,658,000
United States	192,000	..	50,000,000
France	1,800	..	17,060,000
Belgium	900	..	14,670,000
Austria	1,800	..	12,280,000
Russia	11,000	..	1,392,000
Nova Scotia	18,000	..	1,052,000
Spain	3,000	..	586,000
Other countries	28,000	..	5,000,000
	270,300		274,262,000

This table shows that, roughly, the total area of the discovered coal-fields of the world amounts to 270,000 square miles.

It also appears that the total coal deposits of Great Britain compare favourably with those of other European countries; but that, both in the United States and in British North America, there exist deposits of extraordinary magnitude, which seem to promise a great future for the New World.

According to the report of the Coal Commissioners, published in 1871, there were then 90,207 million tons of coal available in Great Britain, at depths not greater than 4000 feet, and in seams not less than one foot thick, besides a quantity of concealed coal, estimated at 56,273 million tons, making a total of 146,480 millions. Since that period there have been raised 600 million tons up to the close of 1875, leaving 145,880 million tons, which, at the present rate of consumption of nearly 132 million tons annually, would last 1100 years. Statistics show that during the last 20 years there has been a mean annual increase in output of about 3½ million tons, and a calculation made at this rate of increase would give 250 years as the life of our coal-fields.

In comparing, however, the above rate of increase with that of population and manufactures, it will be found that the additional coal consump-

tion has not nearly kept pace with the increased demand for the effects of heat, the difference being ascribable to the introduction of economical processes in the application of fuel. In the case of the production of power, the economy effected within the last 20 years exceeds 50 per cent., and a still greater saving has probably been realized in the production of iron and steel within the same period, as may be gathered from the fact that a ton of steel rails can now be produced from the ore with an expenditure not exceeding 50 cwts. of raw coal, whereas a ton of iron rails 20 years ago involved an expenditure exceeding 100 cwts. According to Dr. Percy, one large work consumed, in 1859, from 5 to 6 tons of coal per ton of rails. Statistics are unfortunately wanting to guide us respecting these important questions.

Considering the large margin for further improvement regarding almost every application of fuel which can be shown on theoretical grounds to exist, it seems not unreasonable to conclude that the ratio of increase of population and of output of manufactured goods will be nearly balanced, for many years to come, by the further introduction of economical processes, and that our annual production of coal will remain substantially the same within that period, which, under those circumstances, will probably be a period of comparatively cheap coal.

The above-mentioned speculation leads to the further conclusion that our coal supply at a workable depth will last for a period far exceeding the shorter estimated period of 250 years, especially if we take into account the probability of fresh discoveries, of which we have had recent instances, particularly in North Staffordshire, where a large area of coal and black-band ironstone is being opened up, under the auspices of the Duke of Sutherland, by our member, Mr. Homer.

Wherever coal-fields are found in Great Britain, they exist, generally speaking, under favourable circumstances. The deposits are for the most part met with at reasonable depths, the quality of the coal is unsurpassed by that of other countries, and although the coal and ironstone do not occur together in all the iron-producing districts, the distance from the coal to the iron is small, compared with that met with in other countries, and the insular position of Great Britain renders water carriage, both for internal communication and for the purpose of export, more readily available than elsewhere. These advantages ought to decide the present contest for cheapness in supplying the markets of the world with iron and steel in favour of this country.

Coal assumes, in many instances, the form of anthracite, and although the South Wales district contains large deposits of this mineral fuel, comparatively little use has been hitherto made of it for smelting purposes. When raw anthracite is used in the blast-furnaces mixed with coke, it has been found that the amount so used should be limited to from 10 to 15 per cent., or the furnace is apt to become choked by an accumulation of decrepitated anthracite. At Creusot, in France, this difficulty was overcome many years ago by crushing the anthracite coal, mixing it intimately with crushed binding coal, and coking the mixture of about equal proportions in Appold's vertical coke ovens. The result is a somewhat unsightly, but exceedingly hard and efficacious coke. A similar method has been followed for some time in South Wales, where coke is now produced containing as much as 60 per cent. of anthracite, bound together by 35 per cent. of binding coal, and a further admixture of 5 per cent. of pitch or bitumen, the whole of the materials being broken up and intimately mixed in a Carr's disintegrator prior to being coked in the usual manner. Coke of this description possesses great power of endurance in the furnace, and is worthy the attention of iron smelters.

In the United States of America, anthracite plays a most important part, being, in fact, the only mineral fuel in the Northern States east of the Alleghany Mountains. Its universal application for blast-furnaces, for heating purposes, and for domestic use, imparts to the eastern cities of the United States a peculiar air of brightness, owing to the entire absence of smoke, which must impress every visitor most agreeably, and the difference of effect produced by the general use of this fuel, as contrasted with that of bituminous coal, is most strikingly revealed in a short day's journey from Philadelphia, the capital of the anthracite region, to Pittsburg, the centre of application of bituminous coal.

In visiting lately the deposits of anthracite coal of the Schuylkill district, I was much struck with their vastness, and with the manner and appliances adopted for working the same. The American anthracite is less decrepitating than ours, but its successful application to its various purposes is the result chiefly of the judicious manner in which it is prepared for the market. The raw anthracite, as it cones from the mine, is raised to the top of a wooden erection some 80 or 90 feet high, in descending through which it is subjected to a series of operations of crushing, washing, sieving, and separating of slaty admixtures, after which it is delivered through separate channels into railway waggons, as large coal, as egg coal, walnut coal, and pea coal, each kind being nicely rounded and uniform in size. The dust coal, which amounts to nearly one-half of the total quantity raised, is allowed at present to accumulate near the mine, but experiments are now being carried out to utilize this also for steam-boiler purposes.

Next in importance to mineral fuel, properly speaking, come lignite and peat, of which vast deposits are met with in most countries. These may be looked upon as coal still in course of formation, and the chief drawback to their use, as compared with that of real coal, consists in the large per centage of water which they contain, rendering them inapplicable in their crude condition to the attainment of high degrees of heat. These difficulties may be overcome by subjecting the wet material to processes of compression, desiccation, and coking, whereby excellent fuel and products of distillation have been obtained, although the cost of their production has hitherto exceeded their market value. Crude air-dried peat has, however, been rendered applicable for obtaining high degrees of heat such as are required for metallurgical operations by means of the regenerative gas-furnace; and it is important to observe that the calorific value of a ton of air-dried peat or lignite, if used in this manner, is equal to that of a ton of good coal, if deduction is made in both cases of the per centage of moisture and earthy matter. The carbonaceous constituents of peat yield, indeed, a very rich gas suitable for melting steel or for reheating iron, and the only precaution necessary is to pass the gas from the producer over a sufficient amount of cooling surface to condense the aqueous vapour it contains, before its arrival at the furnace. This precaution is not necessary, however, in dealing with some of the older lignites, such as occur abundantly in Austria and Hungary, and which may be ranked as almost equal in value with real coal, except for blast-furnace purposes.

Fuel also occurs naturally in the gaseous condition—a fact but too well known to every practical coal-miner. Occasionally, however, it is found separated from the coal with which it may have been primarily associated, and in those cases it has been made practically available as fuel. At Bakoo, on the Caspian Sea, natural gas has issued spontaneously from the ground for centuries past, and the column of perpetual fire thus produced has served the purpose of giving the Parsees a holy shrine at which to worship their deity. In the district of Pennsylvania a more substantial application has been made of the gas issuing from many of the borings, in providing fuel for working pumping machinery, and in lighting the district. The quantity of gas issuing from some of these wells may be judged from the fact that one of them, after discharging for three years as much gas as could escape into the atmosphere under a pressure estimated at not less than 200 lbs. on the square inch, has lately been connected by means of a 5-inch pipe with Pittsburg (a distance of 18 miles) where 70 puddling and reheating furnaces are worked entirely by the fuel so supplied. But even this result furnishes only an imperfect idea of the calorific power represented by this single issue of natural gas, inasmuch as the combustion is carried on in these furnaces on the most wasteful plan, the gas being mixed imperfectly with cold air, and converted to a large extent into dense masses of smoke. An analysis of this gas gives:—Hydrogen, 13·50; marsh gas, 80·11; ethylene, 5·72; carbonic acid, 0·66.

Although the use of natural gas is not likely to assume very large proportions, owing to its rare occurrence, its application at Pittsburg has forcibly reminded me of a project I had occasion to put forward a good many years ago, namely, to erect gas-producers at the bottom of coal-mines, and by the conversion of solid into gaseous fuel, to save entirely the labour of raising and carrying the latter to its destination. The gaseous fuel, in ascending from the bottom of the mine to the bank, would acquire in its ascent (owing to its temperature and low specific gravity), an onward pressure, sufficient to propel it through pipes or culverts to a considerable distance, and it would be possible in this way to supply townships with heating gas, not only for use in factories, but, to a great extent, for domestic purposes also. In 1869 a company, in which I took a leading interest, were formed at Birmingham, under the sanction of the Town Council, to supply the town of Birmingham with heating gas at the rate of 6d. per 1000 cubic feet, but their object was defeated by the existing gas companies, who opposed their Bill in Parliament, upon the ground that it would interfere with vested interests. I am still satisfied, however, that such a plan could be carried out with great advantage to the public; and, although I am no longer specifically interested in the matter, I would gladly lend my aid to those who might be willing to realize the same.

Fuel also occurs naturally in the liquid state, and if mineral oils could be obtained in quantities at all comparable to those of solid fuel, liquid fuel would possess the advantages of great purity and high calorific value; but, considering its rare occurrence and comparatively high price even in the oil districts of Pennsylvania and Canada, its use, as a fuel for smelting purposes, need not be here considered.

According to the general definition of fuel given above, we have to include the evaporative effect of the sun's rays, by which sea water is raised to elevated mountain levels, whence it descends towards the sea, and in doing so is capable of imparting motion to machinery.

This form of fuel, which takes the place of the coal otherwise expended in raising steam, has been resorted to in all countries since the dawn of civilization, and it is owing to this circumstance that the industries of the world were formerly very much scattered over the valleys and gorges of mountainous districts, where the mountain streams gave motion to the saw-mill or flour-mill, to the trompe of the iron smelter, and to the helve of the iron and steel manufacturer.

THE ECONOMICAL CONSUMPTION OF GAS.

Mr. JOHN WEST, Manager of the Maidstone Gas-Works, delivered a Lecture on the above subject at a meeting of the Maidstone and Mid-Kent Natural History and Philosophical Society, on the 22nd ult.

Mr. West commenced his lecture by remarking that although the use of gas had become almost general, on account of its purity and cheapness, as compared with other artificial means of lighting and heating, there were comparatively few persons who sought the most efficient and economical way of obtaining the maximum amount of light contained in the gas consumed. Knowing that defective burners caused a great loss of light to the public, he thought he might be rendering some service if he dwelt briefly on the cause of the loss of illuminating power when defective burners were used, and suggested the best known principles. For some years past several eminent men, such as Dr. Frankland, Dr. Letheby, and others, had given the question of gas-burners their special attention, and some of the manufacturers had spent large sums of money in producing the most efficient specimens. The burners now in use were Argands, which gave a ring of light and required glass chimneys, and those with flat flames known as bat's-wings and fish-tails. The relative power of these artificial lights was determined by the use of photometry—by the well-known law in optics of a light lessening in proportion to the squares of the distance. The standards of comparison were sperm candles, as defined by Act of Parliament, which stated that the gas supplied in Maidstone should be tested with an Argand burner, and when consuming 5 feet per hour, should give a light equal to 12 sperm candles of six to the pound, burning at the rate of 120 grains per hour. Pointing to two rows of jets before him, where the same kind of gas was used with a variety of illuminating power—the one row producing splendid yellow bands, which gave forth innumerable rays of light, while in the other (selected from some Maidstone houses) the luminous bands were scarcely visible—the lecturer remarked that to the existence of the solid carbon particles the light of candles or coal gas was mainly due. If the conditions were altered a little, a great change would be effected. By taking a candle and blowing into the flame, the result would be that most of the light would disappear. The reason of this was that in blowing into the flame the oxygen was forced in, so that when the separation of the elements of the gas took place, the carbon could combine with the oxygen, as well as with the hydrogen, and there were then no free particles of carbon in a state of suspension to be heated, as in the case of light-giving flames. In the Bunsen burner, which was extensively used for heating purposes, air was mixed with the gas before it was burnt; the carbon combined easily with the oxygen, and there was no light. Tripod burners had been in use at St. Peter's Church for the combined purpose of lighting and heating, and when taken down for repairs, he (the lecturer) recommended that four of Bray's burners should be fixed upon each standard. These, it was found gave more light, and consumed less gas than the four original burners, although these were tripods. One of the latest improvements was called the "Bray special." These were excellent burners, and the cost was so small that he was convinced they would be largely adopted. The lecturer next spoke of the Argand burners, which he considered the most perfect instruments for consuming gas. These burners were of proportions which had been very nicely worked out, so that the quantity of gas the burner was required to consume might pass out at an inappreciable, or the least possible, pressure, in order that the oxygen of the atmosphere, slowly ascending through the centre and round the flame, might combine with the burning gas by natural affinity. All these improved burners had obstructions in them for checking the flow of gas to the point of ignition, while the pressure of the gas in the old ones exerted itself at the very tip of the burner, and forced the gas boisterously into the atmosphere. If air were forced into a flame, it destroyed its light-giving properties; so, on the other hand, if the gas were forced boisterously into the atmosphere, there was a like result. It was the different ways in which the gas issued from the various burners which caused the difference in the amount of light. In one case there were burners which required great pressure to force the gas through the small orifices, with the result that they induced currents of air to rush boisterously into them. In the other case the gas streamed forth gently, and the air quietly drew to it the necessary supply of oxygen. Before regulating instruments,

or "governors," were used for the street-lamps of Maidstone, the double burner was in operation. This burner had been tested by himself and a late surveyor of Maidstone (Mr. Buckham), and compared with the regulator or governor, and they found that the increase of light due to the governor when consuming the same quantity of gas was between 3 and 4 candles. The public might therefore, it was discovered, have this increase of light for the same money. The local authorities saw the advantage, but then came the question as to who ought to pay for them. The directors of the gas company, however, generously instructed him to fix them upon all the lamps in the town. Regulators could be adjusted to consume a given quantity of gas, and would remain nearly accurate under all the varying pressures in the gas-mains. As such accurate measurings could be obtained, all that was to be done was to decide the number of hours the lamps should be lighted. This was the way the gas company contracted with the local board, and he said unhesitatingly that when local authorities and gas companies had confidence in each other this was the best mode of supplying the gas to the public lamps, and he believed time would prove it. But if towns were not satisfied with this mode, by all means let them have meters attached to the lamps, which meant, of course, a large outlay, and constant expense. The chief thing now was to see that the regulators supplied the quantity of gas contracted for, and burnt during the proper number of hours. These regulators were made any size, and could be adapted either to private meters or burners. Both for the health and pocket's sake, those burners should be used which produced the most light, and extracted from the air the smallest quantity of oxygen. In conclusion, the lecturer remarked that gas might be used economically for cooking and heating purposes, but in all cases the products of combustion should ascend the chimney. For heating purposes, the Bunsen burners were commonly used, and many persons believed that gas burned in this way gave out more heat than the ordinary luminous flame. This was quite an erroneous idea, the chemical combination being the same. The Bunsen flame, however, was better suited for some purposes, as the thing to be heated might be placed in contact therewith, without soot or carbon being formed on the bottom. Mr. West illustrated several of his remarks by tables, which showed that of nine burners selected from various houses in Maidstone, three, when calculated to consume 5 cubic feet of gas per hour, gave respectively a light only equal to 5·9, 8·23, 3·23 sperm candles, the average illuminating power of the nine examples being 7·56 candles. During the experiments, the gas gave by the standard test burner, when consuming 5 cubic feet per hour, a light equal to 15·13 candles. At the same time, the illuminating power of 15 improved kinds of burners, as supplied by the gas company, when calculated to consume 5 cubic feet per hour, ranged from 11·46 to 15·66 candles, varying according to the sizes and kind of burners used. The deduction drawn was that there is a loss to the public of from about 20 to 70 per cent. of light when gas is consumed through bad burners. The lecturer, while upon this point, added that improved burners had for some time past been used in Maidstone, which was now better supplied in this respect than most other towns. He had for years endeavoured to get consumers to use good burners, as he found that most of the complaints received arose through defective ones being employed.

At the close of the lecture, Dr. Monckton, who presided, invited discussion.

Mr. M. A. Adams, after remarking that the lecturer had dealt with his subject in an admirable way, said that gas contained about 50 different substances, the chief of which consisted of marsh gas, or coal damp, as it was called in the mines; another part was hydrogen; and the remaining parts existed in very minute proportions. Mr. Adams then entered into a long explanation of the way in which the gas was consumed, and the various parts of the flame acted upon by the air, and concluded by saying that he quite agreed with Mr. West that the thick flame was better than the other forms.

Mr. Edmett asked if the blue light was equal in heat to the yellow, when given out from a Bunsen burner.

Mr. West, in reply, said Mr. Adams had spoken of gas containing about 50 substances; but he (Mr. West) had not gone into this branch of the subject, as he did not think that it came within the range of their inquiry that evening. With regard to the Bunsen burner, there was the same amount of heat from a blue, white, or yellow flame. To illustrate the usefulness of this burner, he might mention that while a luminous flame, in a recent experiment, took two hours to boil 60 gallons of water, the Bunsen only took about half that time, burning the same amount of gas. The advantage of these burners was that they were quick and clean in their action; but he repeated that no more heat was given out from them than from the ordinary luminous flame.

Dr. Monckton felt his soul harassed by what had been said about the Bunsen burner. He looked upon that arrangement as a valuable heat-appliance, and as not at all deserving to be contemptuously mentioned. Judged in any ordinary way, he believed the flame would be found less voluminous and of greater heat than common flame, and this because, from the interfusion of air, the combustion of the carbon was more instantaneously complete, none of that collection into reservoirs, and gradual exposure to oxygen on the outer surface only, which Mr. Adams had described, having to be gone through. Although, of course, neither this device, nor any other, could increase the total amount of heat which a foot of gas would yield, it was quite possible to bring that heat to bear more compactly and pointedly on practical work. Later on, while tendering the hearty thanks of the meeting to Mr. West for his practical address, Dr. Monckton expressed a wish that the gas company would assume a more active responsibility for the apparatus wherewith their product was consumed; the public should be accustomed to rely upon them for those suggestions and improvements, in search of which they were now often made a prey of by itinerent pretenders.

The vote of thanks to Mr. West was then heartily accorded, and the proceedings terminated.

GAS AFFAIRS IN AMERICA.

REPORT OF THE GAS COMMISSIONERS IN RELATION TO THE SUPPLY OF GAS TO THE CITY OF BOSTON.

(*Concluded from page* 466.)

Competition.

In regard to the admission of another gas company into Boston to compete with the Boston Gaslight Company, we are firmly of the opinion that no such competition should be permitted, unless the competing company be owned and managed by the city of Boston itself; and this opinion has been formed from a study of numerous cases of unsuccessful competition in supplying gas to cities in both the United States and Europe. By unsuccessful we mean that the competition has not succeeded in permanently lowering the price of gas to the citizens. It has invariably resulted in a compromise as to price or district, except in the case of Detroit, where the battle is still raging. In New York the city is divided between the New York, Manhattan, and Metropolitan Companies, each supplying a separate district, and the New York Mutual Company is allowed to lay its pipes anywhere in the city and compete with the other three. The result of this is that the citizens are obliged to pay 25 cents more per 1000 cubic feet than in Boston; whereas the price should, if anything, be lower than in Boston. The citizens are in each district, therefore, obliged to pay the interest on two capitals instead of one. The same is true of Brooklyn, N.Y., where there are six companies—the Brooklyn, Citizens, Nassau, Metropolitan, People's, and Williamsburg. Here the compromise has been effected by dividing the district, and raising the price to 50 cents per 1000 cubic feet more than is paid in Boston. Up to April 1, 1876, the price was 3·00 dols.; but at that time it was reduced to 2·75 dols. On Sept. 1, 1876, the price was reduced by the Citizens Company to 2·50 dols. Recently permission has been granted to a seventh company to lay pipes in the streets and compete with the others. What will be the result of this remains to be seen, but it will probably be the same as heretofore—viz., another division of the district. In San Francisco, a competing company was allowed by the city authorities to lay gas-mains in the streets under a written agreement that it should not sell out to the old company; but after a short season of cheap gas the new company was absorbed by the old one, under a change of name, and we now find the citizens paying advanced rates, and seeking redress in the Legislature, where an Act has been passed recently, authorizing the supervisors of the city of San Francisco to fix the price and quality of the gas at rates not exceeding 3·50 dols. per 1000 cubic feet for gas of not less than 15-candle power. This price may appear very high; but it must be remembered that the gas coals are all imported from Australia, at a cost of 11 or 12 dols. per ton, and that the rates of labour are far in excess of our own.

In reference to this question, we may quote the paragraph from John Stuart Mill, which was read at the hearing before the Board of Aldermen in 1874 (page 124), by Mr. Nathaniel C. Nash, which the experience in all cities in which competition has been thoroughly tried substantiates:—

> When, in any employment, the *régime* of independent small producers has either never been possible, or has been suspended, and the system of many workpeople under one management has become fully established, from that time any further enlargement in the scale of production is generally an unqualified benefit. It is obvious, for example, how great an economy of labour would be obtained if London were to be supplied by a single gas or water company, instead of the existing plurality. While there are even as many as two, this implies double establishments of all sorts, when one only, with a small increase, could probably perform the whole operation equally well; double sets of machinery and works, when the whole of the gas or water required could generally be produced by one set only; even double sets of pipes, if the companies did not prevent this needless expense, by agreeing upon a division of the territory. Were there only one establishment, it could make lower charges consistently with obtaining the rate of profit now realized. It is, however, an error to suppose that prices are even permanently kept down by the competition of these companies. Where competitors are so few, they always end by agreeing not to compete. They may run a race of cheapness to ruin a new candidate, but as soon as he has established his footing they come to terms with him. When, therefore, a business of real public importance can only be carried on advantageously upon so large a scale as to render the liberty of competition almost illusory, it is an unthrifty dispensation of the public resources that several costly sets of arrangements should be kept up for the purpose of rendering to the community this one service. It is much better to treat it at once as a public function; and if it be not such as the Government itself could beneficially undertake, it should be made over entire to the company or association which will perform it on the best terms for the public. In the case of railways, for example, no one can desire to see the enormous waste of capital and land (not to speak of increased nuisance) involved in the construction of a second railway to connect the same places already united by an existing one; while the two would not do the work better than it could be done by one, and, after a short time, would probably be amalgamated. Only one such line ought to be permitted; but the control over that line never ought to be parted with by the State, unless on a temporary concession, as in France; and the vested right which Parliament has allowed to be acquired by the existing companies, like all other proprietory rights which are opposed to public utility, is morally valid only as a claim to compensation.

The relation of the public to the gas companies does not materially differ from its relation to the railroad corporations. It is practically dealing with what, from the nature of things, must be a monopoly. The manufacture and sale of gas is not to be considered similar to other branches of manufacturing. When extraordinary profit is realized from other branches of manufacturing, new capital is attracted and profits find their level. New gas companies cannot be established within the same territory. Competition is not to be relied on to control prices in the manufacture and sale of gas any more than in the reduction of transportation charges on railroads. Competition in each case is only incidental, and, while railroad and gas corporations may for a time engage in competition, it is only for the purpose of eventual combination, in which the public interest must suffer. In the early days of railroads in this country and England, competition was regarded as a sovereign remedy for high rates of transportation; but the result has shown a vast waste of capital, and compelled the public to pay interest on the cost of many lines which should never have been built. In gas companies the result has been the same, wherever competition in the same district has been carried to its legitimate and necessary issue. But one line of main-pipes was necessary to supply the public wants, and wherever two were laid, in some form or other the consumer must pay the cost upon the unnecessary expenditure. Such a competition has led to precisely the result which might have been expected—a combination of, or compromise between, the companies, and an increased rate for gas to the consumers, to pay the interest on the unnecessary outlay of capital.

While the public interest in the proper and economical management of gas companies is less in extent than that in the management of railroad corporations, it is precisely of the same nature. Both are and must remain monopolies. Both are liable to be conducted arbitrarily and in a manner to injure and abuse. The railroad corporations of this State have been always controlled by law, while the gas companies have been left to pursue their way unchecked and untrammelled; and it is due to their managers to say that, in most instances, they have not abused the licence they have enjoyed.

The railroad corporations have been required from the outset to render to state officials public returns of their investments and business, which, if not strictly accurate, still in some measure enable the public to understand the extent of their business, and the amount of their earnings and profits. The gas companies, enjoying a practical monopoly, have been required to do nothing of the kind, and there has been a complete ignorance, on the part of the public, of the nature of their business, its extent, and the amount of their profits.

At the hearing before the city authorities, in 1866, it was found impossible to ascertain the cost of the manufacture of gas, and its details could not be satisfactorily learned at the hearing in 1874. If the same publicity of accounts had been required of the gas companies as of the railroad corporations in former years, the labour of this commission would have been simplified, and much less time have been required in reaching its results. It is easy to examine the condition and business of the London gas companies to the most minute detail, while it is impossible to state with absolute confidence the cost of making gas in this country.

There would seem to be no reason why the gas companies of this State should not be required to make public the details of their business in the same manner as the railroad corporations, in the same manner as the London gas companies are required to do. While there should be, and probably is, no disposition to complain of a reasonable profit to be realized from the manufacture and sale of gas, fairly commensurate with the capital employed and risk involved, the privacy with which the accounts of these companies have been kept has led the public to believe that the profits are

very large, and has probably induced the feeling of hostility to gas companies which it cannot be denied is very prevalent in the community.

If it be conceded that it is desirable to follow as nearly as we may the English plan, and establish the principle that the supply of gas shall be furnished by corporations, which shall enjoy a substantial monopoly of the business, but as a condition of such monopoly shall be subject to strict regulation, and should make public the details of their business and profits, the question at once arises, in whose hands shall be placed the supervision and inspection which in London is given to the Board of Trade? We have no body similar in form and position to the London Board of Trade. There is no city official to whom the Legislature would be likely to grant such power if it could; and it may well be doubted if the Legislature could grant such a power to the city of Boston, or any board or official to be appointed by the city. If it is a need of the city of Boston, it may well be considered a public want, to be provided for by a general law applicable to all the gas companies in the State.

What is needed is the establishment of a permanent board of competent men, who shall make it their business to become acquainted with the business of manufacturing gas, and with the operations of the various companies engaged in the manufacture within the State. The corporations should be required to make returns semi-annually of all their doings to this board, as fully as the London companies are required to. The board should be required to make frequent inspection of the quality and purity of the gas furnished by the different companies, and make public from time to time the results of their inspections. It should be empowered to investigate all complaints against gas companies by their customers. It would not be necessary, and perhaps not wise, to give such a board compulsory power to enforce its decrees. It should be rather an advisory board, with sufficient knowledge of the subject to understand fully the matters with which it is dealing; to keep the public fully informed of all improvements made in the manufacture of gas; and to keep the corporations informed of all advances made by other companies—in a word, to keep a careful watch over all the business of all gas corporations in behalf of the public, as the managers of gas companies do in behalf of their stockholders, and to be able at any moment to advise the corporations and their customers and municipal corporations of the proper economies of the gas manufacture, and of the methods and success of any particular corporation; to suggest experiments, and advise what steps should be taken to correct abuses and prevent complaints.

The results of the establishment of a Board of Railroad Commissioners in this commonwealth suggests the propriety of the establishment of a similar commission for the manufacture and sale of gas. The Board of Railroad Commissioners was established in 1869, and was practically a board without direct powers, intended to be an advisory board of competent men, in permanent session, to examine into the condition and business of the railroads, and to make such suggestions and recommendations to the railroad corporations and to the public authorities as seemed judicious; to hear complaints and disputes, without power to adjudicate and enforce its decrees, but simply to advise, and, in case its advice is unheeded, to report facts to the public and the Legislature.

It would derive its power from two sources—first, from the influence which a competent arbiter should have, whose sole duty is to carefully study the various questions arising in the transaction of business of great importance, and from its nature not understood by the public at large; and, second, from the natural effect of public opinion directed and controlled by an official body upon corporations, which are peculiarly sensitive to popular feeling.

There can be little doubt that the influence of the Railroad Commissioners has been powerful over the railroad corporations of this commonwealth. Without direct power, it has hastened the adoption of improvements in railroad economies, has secured the keeping of more accurate accounts, and has kept the public informed of the business of the corporations, and the corporations of the advances made by each other, and of the inaccuracies which had crept into their own system and accounts. It has corrected many popular fallacies in regard to the duties and business of railroad corporations, and has shown to railroad managers, through the results of actual experiments over other lines, the possible effect of similar trials upon their own.

Just such a commission upon the manufacture and sale of gas we believe would be of great benefit to the gas corporations and to the public. The law establishing such a commission should require returns to be made by the gas companies of the State as are now made by the London gas companies, and power should be given to recommend improvements and experiments. It should have the same power and jurisdiction in hearing complaints as is given in similar cases to the Railroad Commissioners, and above all should keep the public fully informed of the condition, business, and profits of the gas companies of the State. Upon the last feature we place great reliance, as promising an improved relation between the gas companies and the public. Publicity of expenditures and accounts should be the condition absolute upon which monopoly can be allowed. The vague darkness in which the business, accounts, and profits of the gas companies are shrouded, and which is the cause of a great part of the jealousy with which they are now regarded, should be for ever abolished.

The present law of Massachusetts professes in the title of the Act, c. 168 of 1861, to provide "for the inspection of gas-meters, the protection of gas consumers, and the protection and regulation of gaslight companies." So far as the interest of gas consumers is concerned, it provides fairly enough for the inspection of gas-meters. This is well; but it is not in the measurement of gas that consumers commonly suffer. It provides in a very inadequate way for an examination of the quality and purity of the gas; it fixes the quality of the mercantile gas at 12 candles, which is too low, and makes no suitable provision to ensure purity of the gas, which is no less essential than its illuminating power. The other provisions of the Act are to promote the interests of the gas companies, to enable them to collect their dues and protect their property. The contrast with the severity of the English law is very striking, and not particularly flattering. The English view of the duties of the gas companies commends itself to our judgment. It treats gas companies as what they must be, monopolies, but subjects them as a condition of the necessary monopoly to strict regulation, and, above all, requires the utmost publicity in all their affairs.

The expenses of such a permanent commission for the whole State could not be very great, to be added to the whole amount paid for gas in the State. These expenses should be assessed upon all the gas companies in proportion to their sales, and in this way distributed *pro ratâ* upon the consumers of gas. And, if the affairs of such a commission were conducted with ability, it would in the end result in a large saving to the public.

Conclusions.

Our conclusions are, for reasons already given, as follows:—

1. That the citizens of Boston are being supplied by the Boston Gaslight Company with gas of excellent quality, and at a price, in comparison with the cost of coal and the quality of the gas, lower than in most of the cities of the United States.* No fair comparison can be made in regard to price with European cities, on account of the great difference in the cost of labour and material, and the value of residuals.

2. That there are other processes than those in use in the various companies in this city by which illuminating gas can be made, and for which great improvements in regard to cost and quality are claimed; but none of these, with one exception, have yet been tried for a sufficiently long time, and upon a sufficiently large scale to warrant an unqualified recommendation. That exception is the substitution of naphtha or petroleum in the place of enriching coal. By this means we consider that great saving may be made, providing that the price of naphtha does not much exceed 10 cents per gallon delivered at the works, and the advisability of employing this substance in the manufacture of gas depends entirely upon the probability or certainty that the price shall not materially exceed this figure. At this present time, however, it would probably be impossible for a large gas company, like the Boston Gaslight Company, to make use of any process for the manufacture of illuminating gas from naphtha or petroleum without either paying a considerable royalty or becoming involved in lawsuits for the alleged infringement of some patent. It is, nevertheless, doubtful whether any of the patents for using petroleum or naphtha in gas-making are valid.

Of the various other processes for manufacturing gas, those now in use in Poughkeepsie and Manayunk, and known as the "Gwynne-Harris" and "Lowe" water-gas processes, offer in our opinion a fair prospect of success, and should be carefully watched and studied. If the recommendations in the next paragraph are adopted, the careful investigation of these processes may safely be left to the permanent commission, who can devote the necessary time, and make the necessary experiments, to enable it to recommend to the gas companies in the State that process which is the most scientific and economical.

3. In regard to the other subjects included in the order quoted at the beginning of this report, we recommend that virtually the same measures should be adopted which have been found, by long and careful consideration of the relation of gas companies to the public, to be best in reference to the London gas companies—viz., the fullest publicity in relation to their entire business. In order to accomplish this result, we would advise the city of Boston to petition to the Legislature of Massachusetts for the appointment of a permanent Board of Commissioners, similar to the Railroad Commissioners, who shall have authority to thoroughly inspect the gas of all the companies in the State, and also, through a competent auditor, to examine all of the accounts of the companies. These accounts should be published annually, so as to ensure publicity, and should be kept according to some one definite plan. The gas inspector or inspectors should be provided with an office at a distance from the works, should examine the gas frequently, and should publish the results of the examinations at least quarterly. The gas should at no time have an illuminating power below 16 candles; it should at all times be free from sulphuretted hydrogen, and should contain an amount of sulphur and ammonia not exceeding 20 grains of the former, and five grains of the latter, per 100 cubic feet.

The commissioners should have the power to recommend the price of gas in all the cities and towns in the commonwealth, at such rates as would allow the earning of a dividend of not more than 10 per cent. on the capital, and any excess of profit should go towards ensuing a diminution of the price the following year. This commission should be the tribunal authorized to investigate all complaints between consumers and the corporation, and the establishment of such a commission would probably result in bringing about such changes in legislation, in regard to its powers and duties, as actual experience should show to be necessary and judicious.

In London it was found impossible to induce the gas companies to consent to all the regulations of Parliament, until a strong effort was made to obtain permission for the municipal government to erect gas-works and sell gas to the citizens, when the companies were obliged to accede to all of the propositions, for fear of the unequal competition with the government. Although we do not deem it necessary to resort to the same expedient, yet the same difficulty can arise in the case of any company whose charter was granted previous to March 11, 1831, at which time an Act was passed rendering all charters granted after that date subject to alteration by the Legislature. We, therefore, recommended that the city of Boston petition the Legislature for an Act permitting the city to erect gas-works, and manufacture and sell gas to its inhabitants; and should it happen that the Boston Gaslight Company, or any other, whose charter is dated previous to 1831, if there be any such, will not comply with such reasonable regulations as may be deemed necessary to ensure publicity in regard to their business, proper inspection of their gas, and a limitation of their earnings, we would recommend that the city of Boston itself, providing the right can be obtained from the Legislature, erect works (or purchase those already erected within its limits) and manufacture gas for the supply of its citizens. The gas supply can be managed in about the same manner as the water supply, which, it cannot be denied, has in past years been very successfully carried on.

We advise, most decidedly, against the admission of another private gas corporation within the limits of Boston to compete in the sale of gas with the existing companies, as being disadvantageous to the public generally.

In the performance of such business as the sale of gas or water, which must be a monopoly, in which the public cannot have the benefits of competition, we consider it beneficial to the public interest that the system of discounts to large consumers should be abolished.

* In Lowell 16-candle gas is supplied to the citizens for the same price as in Boston, although the cost of the common coal is 1·00 dol. more per ton, the consumption less, and the district more unfavourable than in Boston.

IRON AND COAL TRADES OF SHEFFIELD, SOUTH YORKSHIRE AND NORTH DERBYSHIRE.

(FROM OUR OWN CORRESPONDENT.)

The week has again passed over quietly as regards most branches of the iron trade, yet I am pleased, in a certain sense, to be able to note that in some branches a rather better tone is apparent. Some brands of forge pig iron appear to be recovering from the long continued depression which has affected them, and are changing hands with a little more freedom than has been observable of late. This is more particularly the case with some of the North Lincolnshire pigs, which are being more largely used by the Leeds and West Yorkshire houses than heretofore. Foundry pig is pretty well upheld in price, and is in very fair request. Particularly good Derbyshire brands, such as Clay Cross, Thorncliffe (South Yorkshire), and Leeds Aireside foundry produce is selling very well, several of the chief concerns being now steadily engaged on actual work in hand, besides having their order-books well filled; prices in consequence are fairly firm.

With reference to the supply of the township of Chapeltown by the Sheffield Water Company, I may state that the main will be laid from the existing pipes of the company at Wadsley, and not from Pitsmoor, as has been stated.

In merchant iron there is a decided tendency to lower prices, as has been evinced during the past few days by the Butterley Company lowering all classes of manufactured and merchant iron to the extent of £1 per ton, making bars £8 at the works, £8 10s. at Sheffield; plates £9 10s.; and sheets £9 10s.

The coal trade remains exceedingly depressed, and prices of all kinds, except slack, have downward tendencies. Coke, too, is abundant and cheap, local qualities being obtainable at 12s. to 14s., and Durham soft at 15s. to 18s. per ton.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

The coal trade generally throughout this district is quiet, and although one or two of the large firms in the Manchester district have been filling up their stocks during the past month, supplies of round coal are plentiful, the only class of fuel that is at all scarce being slack, which is due to the small winter demand for house-fire coal. There have been a fair number of inquiries for cannel, but there has not been much placed, and, apparently, the inquiries are only intended to feel the market. Colliery proprietors, therefore, are not pushing their get, but are rather limiting their production wherever they can without injury to their mines. For the very best qualities of coal, which are in few hands, the demand is pretty nearly equal to the supply; but, in seconds and inferior sorts, the production is considerably above the market requirements, and, where the pits are not put on short time, stocks are accumulating. Good burgy meets with a fair inquiry, but common sorts are a drug. For slack more money is being asked; this month one of the large firms in the Manchester district having advanced their quotations 5d. per ton, and in the South-West Lancashire district, advances of 3d. and 6d. per ton are being asked. The average pit prices, for sales in bulk, are about 9s. 6d. to 10s. per ton for good Arley; 8s. 6d. to 9s. for common; 8s. 6d. to 9s. for good Pemberton four-feet; 6s. 6d. to 7s. for common coal; 5s. to 5s. 6d. for burgy; and 3s. 6d. to 4s. 6d. per ton for slack.

In the shipping trade there is very little doing beyond a few gas coal shipments, and low prices and keen competition are still the prevailing feature.

Systematic short time is now being adopted at some of the pits in the Wigan district, and other collieries, as a rule, are simply working up to their orders, which keep them going about four days a week.

In the iron trade there is still very little doing, and extremely low prices continue to rule in this market for most of the outside brands. Local makers, however, still make no change, and for delivery into the Manchester district they will not quote less than 56s. to 57s. per ton for No. 3 foundry; and 54s. 6d. to 55s. 6d. per ton for No. 4 forge, less 2½ per cent. For finished iron, quotations are much about the same; Staffordshire bars, delivered into this district, being quoted at £6 17s. 6d. to £7; and Middlesbrough, Lancashire, and Sheffield ditto, at £6 11s. to £6 17s. 6d. per ton; but this branch of trade is very flat, and prices are weak.

THE COAL AND GENERAL TRADE OF THE NORTH.

(FROM OUR OWN CORRESPONDENT.)

The shipments of coals from the Tyne and Wear were better last week. There was a very large supply of tonnage. More gas coals were shipped, and some few more contracts have been made abroad for the supply thence of gas, steam, manufacturing, and coking coals, but at low figures. It is pretty clear that low as steam coals are in price, they will have to be reduced; and as the season is approaching when there will be less demand for gas coals, these sorts will not hold such a commanding position in the market. In fact, the general character of the operations which are going on, and the few new contracts which have been made upon Newcastle Quayside for forward delivery, are done upon the presumption that coals will be lower the further we get into the spring. The Durham coalowners have given notice to their engineers, and to the coke burners and other off-handed men, of a further reduction of wages. The shipments of gas coals by steamers maintain a fair average coastwise. There is also a pretty fair demand for the Scandinavian ports, and for the Lower Baltic. Business is likewise opening for Cronstadt and the Upper Baltic ports.

Freights continue to favour shippers, who have the command of the market, and, if business continues as it is, will do during the first half of 1877. There is absolutely no change in the value of coasting freights. There is an abundance of little ships to load fire-bricks and other goods needed to be taken above bridge in London, and also for the large ports. Steamers do more than two-thirds of the coal trade to London, Rochester, Hamburg, and the French ports; and they take less money per ton than sailing ships are able to do. The rates paid to steamers to load coals for the Baltic and the Mediterranean are likewise low.

The best gas collieries keep up to full time; second-class cannot do that, and the steam collieries do not average five working days a fortnight.

Manufacturing business has a little more cheerful look as the spring advances. The trade which is doing, however, is for immediate delivery. There is no extension of works going on anywhere of moment; hence bricks and fire-clay goods of all kinds, new machinery, and cement are not greatly looked after, and are mostly shipped in small parcels. The chemicals most in demand abroad are bleaching powder and soda. The chemical market is undoubtedly firmer, and manufacturers continue to decline to take orders for forward delivery at the current rates.

Little need be said with regard to the iron trade. The amount of business transacted during the last week was comparatively insignificant. Makers were reported to have a large stock of pig iron on hand. Owing to the state of political affairs on the Continent, there have been few purchasers of pig iron in the market. The finished iron trade remains in a depressed state.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

At a meeting of the committee of the North British Association of Gas Managers, held in Edinburgh last Wednesday, the resolution was carried into effect, which was passed by the members of the Association at the last annual meeting—namely, to present Dr. Stevenson Macadam, F.R.S.E., with a small testimonial in recognition of his many valuable services freely given to the Association, and likewise as a mark of the high esteem in which he is held by the members. The present took the form of a handsome silver epergne, bearing a suitable inscription. The presentation was made by Mr. A. Macpherson, of Kirkcaldy, the President of the Association, and was acknowledged by Dr. Macadam. Cake and wine were thereafter served, and several toasts suitable to the occasion were proposed and responded to.

Within the last few weeks I had occasion to mention that it had been resolved by the Glasgow Corporation Gas Committee to divide the gas supply area into a number of districts for the purpose of instituting a system of applying a gas-governor to each of them. The suburban district of Pollokshields, which is quite adjacent to the Tradeston Gas-Works, is to be the first to enjoy the benefits of a regulated pressure. I am informed that the governor to be employed is one that has recently been devised and patented by Mr. Foulis. In the first instance, it is to be fixed upon an 18-inch main. As regards its simplicity of structure, its great sensitiveness when in action, and its small size relatively to the mains upon which it may be used, it has been very favourably spoken of. It was recently on view at the Corporation gas testing-station and meter-works, Alston Street, and it is expected that in the course of a week or two we shall be able to have its powers tested on an actual working scale.

At the village of Kilmalcolm, which is fast becoming an important residential suburb of Glasgow, although it is at a distance of ten miles or so, strenuous efforts have been made during the past winter to have the roads and streets lighted with gas. By means of a voluntary subscription raised amongst the feuars, a number of lamps were erected, and for the past three months they have been doing good service. Quite recently a public concert has been given in the village, for the purpose of adding to the fund. The lamps have now been handed over, free of expense, to the villagers as their property, and a committee, consisting about equally of feuars and ratepayers, have been appointed to provide the ways and means for maintaining the lighting in future; or, I suppose, until the time when the village shall become a burgh by the adoption of the Police (Scotland) Act.

During the past winter street lighting has also engaged the attention of the municipal authorities of the city of Aberdeen. An improvement has taken place in the lighting of the principal streets, by the introduction of flat-flame burners in place of the old cockspur jets. There are now 930 lamps which have the new burners, and as quickly as arrangements can be made for doing so the remaining 1186 will be supplied with them. With the view of still further improving the light, it is intended to supersede the present tin-plate tops by glass ones, which act in a measure as reflectors, thereby throwing the light over a greater area than is possible by the present arrangement. The lamps, to the number of 182, of about ten or a dozen public thoroughfares, have been furnished with the new tops, and gradually the lamps in the other districts of the city will be similarly improved.

Serious complaints are being made by gas consumers in Forfar regarding the quality of the gas which is supplied to them. One correspondent says that in his case it cannot be due to the small size of his meter and distributing-pipes, as they are suited for the supply of 30 burners, whereas he generally uses only five. Neither is it due, he says, to the use of old and inefficient burners; and he affirms that, in place of the gas supply improving, it is every week getting worse, both in quality and in quantity. Mr. Lowson, chairman of the Gas Committee, is inclined to treat the complaints lightly, if not even cavalierly.

The Denny Gas Consumers Company have declared a dividend of 5 per cent., and notified a reduction in the price of gas of 5d. per 1000 feet. It is 16 years since the company were formed, and this is the first dividend they have been able to declare.

The action-at-law raised in the Court of Session by Messrs. Edington and Sons and Messrs. D. Y. Stewart and Co. against the Dundee Water Commissioners, for payment of a large sum of money, which is alleged by the pursuers to be due to them for extras, is now under the consideration of Lord Curriehill and a jury. A number of important witnesses have been examined on behalf of the pursuers, and it would almost seem as if the case were to last for some days longer yet. While it is still *sub judice* it is not desirable that I should express any opinion upon the merits of the case. Several of the most eminent advocates at the Scottish bar, including the Lord Advocate, are engaged in it.

There is now every likelihood that the drainage of the extended burgh of Kirkcaldy will be immediately pushed foward. At one time it was thought that the ratepayers and feuars of Pathhead would insist upon the district being made a special drainage district; but they have wisely resolved to join with the other parts of the extended burgh for a general system of drainage, to be carried out by the imposition of a uniform rate over the whole district. A sum of at least £9000 will be expended on the proposed works. It is expected that operations will be commenced without much further loss of time.

The pig iron trade has been exceedingly dull during the past week, and the market closed on Thursday afternoon with the price at 53s. 7½d. cash. Owing to wages disputes, a number of blast furnaces have been temporarily damped out.

There have been a few more orders for house coal recently, and shipping orders have also been more plentiful, but prices are in an unsettled condition, with little or no appearance of improvement.

GAS APPARATUS EXHIBITION.—We call the attention of our readers to the announcement made in our advertising columns, that the opening of the exhibition projected by the South Shields Gas Company will take place on Monday next. From the interest attached to this exhibition we trust there will be a large attendance.

DEATH OF MR. C. E. CAWLEY, M.P.—The announcement of the death of this gentleman, so well known in political and gas circles, appeared in the papers of yesterday. Mr. Cawley was by profession a civil engineer, and was for some years chairman of the Salford Corporation Gas Committee. Since 1868 he had represented the borough of Salford in Parliament.

SCARBOROUGH WATER COMPANY.—A meeting of the shareholders of this company was held on Monday, March 26th—the Mayor (Mr. B. Fowler) presiding—to present a testimonial to the chairman of the company, Mr. John Woodall, who had presided over their affairs ever since the formation in 1845. The memorial consisted of a large and massive silver vase, 36 inches in height, parcel gilt and oxidized, and bearing a suitable inscription.

REDUCTIONS IN THE PRICE OF GAS.—The Leamington Priors Gas Company have agreed to make a reduction of 3d. in the price of gas, which will now be charged 4s. per 1000 feet. At the meeting of the Horncastle Local Board on the 22nd ult., it was decided that the price of gas from Jan. 1 to June 30, 1877, be 4s. 7d. per 1000 feet. This is a reduction of 1s. 3d. per 1000 on the amount paid before the purchase of the gas-works by the local board.

SALE OF PROVINCIAL GAS SHARES.—On Tuesday, the 20th ult., twelve £10 paid-up shares in the Folkestone Gas Company were sold by auction, and realized £21 7s. 6d. each; and three shares of the same company of the capital created in 1876, at £15 17s. 6d. each. Ten £5 paid-up shares in the Rochester and Chatham Gas Company were sold by auction on the 27th ult., and realized £8 5s. each, and ten £10 shares in the Hornsey Gas Company for £20 each.

STOCKTON AND MIDDLESBROUGH CORPORATIONS WATER-WORKS PURCHASE.—The joint committee appointed by these corporations to arrange the details for the transference of the water-works under the Act of last session, have served the requisite notices on the directors of the water company, in order thereon to obtain possession of their undertaking, and they have recommended the councils to appoint Mr. Venables, Q.C., their leading counsel when the Bill was in Parliament, to act for them in the approaching arbitration. The recommendation has been approved.

Register of New Patents.

APPLICATIONS FOR LETTERS PATENT.

1049—WESTON, G., Sheffield, "The lighting and extinguishing of public and other lamps." March 16, 1877.

1063.—LAKE, W. R., Southampton Buildings, London, "Improvements in gas motor engines." A communication. March 16, 1877.

1064.—LAKE, W. R., Southampton Buildings, London, "An improved method of treating sewage for separating the liquid from the solid portions thereof, and deodorizing and purifying the same." A communication. March 16, 1877.

1068.—Bradshaw, A., Accrington, Lancs, "Improvements in gauges for recording pressures." March 16, 1877.
1104.—Firmin, W., Hackney Road, London, "Improvements in ball-valves or ball-cocks." March 20, 1877.
1126.—Spruyt de Bay, C., Westminster, "A new method of and apparatus for giving movement or power to liquids or air or other gas, or for receiving it from the same." March 21, 1877.
1127.—Clark, A. M., Chancery Lane, London, "An improved process for preventing the accumulation of carbon in retorts used for the distillation of carburetted hydrogen." A communication. March 21, 1877.
1152.—Cotton, J., Bradford, York, "An improvement in the construction of taps and cocks." March 23, 1877.
1158.—Bell, W., Great Suffolk Street, London, and Blagburn, C., Newcastle-on-Tyne, "Improvements in pumps." March 24, 1877.
1160.—Wilson, W. P., Peckham, London, "Improvements in apparatus used in the manufacture of gas." March 24, 1877.
1167.—Morgan, T., Charing Cross, London, "Improvements in engines and pumps actuated by steam or other power." A communication. March 24, 1877.
1180.—Singer, A. W., Coventry, Warwick, "Improvements in shifting spanners." March 26, 1877.
1184.—Paris, J., Stratford, London, "Improvements in flat irons to be heated by gas and air, and in burners for the same." March 26, 1877.
1209.—Verstraeten, T., Brussels, "Improvements in joining together the ends of pipes and tubes." March 27, 1877.
1223.—Sirié, C. A., Paris, "An improved apparatus for carburetting lighting gas." March 28, 1877.
1246.—Young, W., Clippens, Renfrew, N.B., "Improvements in the destructive distillation of coal and other bituminous substances, the same being in part applicable to the manufacture of oil and gas." March 29, 1877.
1250.—Brinjes, J. F., Whitechapel, London, "Improvements in machinery or apparatus for raising, forcing, and exhausting water and other liquids, also air and gases." March 29, 1877.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

3786.—Brewer, E. G., Chancery Lane, London, "Improvements in fire-engines and pumps, and in apparatus connected therewith." A communication. Sept. 28, 1876.
3884.—Martin, J. R., Shoreditch, London, "Improvements in rotary pumps and engines." Oct. 7, 1876.
4296.—Westinghouse, G., jun., Pennsylvania, U.S.A., "Improvements in and in apparatus for lighting railway carriages." Partly a communication. Nov. 7, 1876.
108.—Osmond, S., Bishopsgate Street Within, London, "Improvements connected with supplying water to closets and for domestic uses." Jan. 9, 1877.
21.—Camargo Pinto, F. de, Kennington Road, London, "Improvements in steam or other fluids, motor-engines, or pumps." Jan. 2, 1877.
422.—Kirkham, C.E., T. N., Westminster, Hulett, D., High Holborn, London, Chandler, S., jun., and Chandler, J., Newington Causeway, London, "Improvements in apparatus for the purification of gas." Feb. 1, 1877.
487.—Mather, W., Salford, Lancs, "Improvements in apparatus to be used in raising water from artesian and other wells." Feb. 5, 1877.
491.—Otto, N. A., Deutz, Germany, and Crossley, F. W., Manchester, "Improvements in gas motor engines." Feb. 5, 1877.

PATENTS WHICH HAVE BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £50 BEFORE THE EXPIRATION OF THE THIRD YEAR.

813.—Goold, G., "Improvements in cocks or valves for regulating the flow of liquids." March 5, 1874.
815.—Haseltine, G., "Improvements in dry gas-meters." March 5, 1874.
839.—Willoughby, J., Southwell, W. A., Briggs, T. J., and Willoughby, S., "Improvements in apparatus for distilling tar and the products thereof." March 7, 1874.

Share List of Metropolitan Gas and Water Companies.

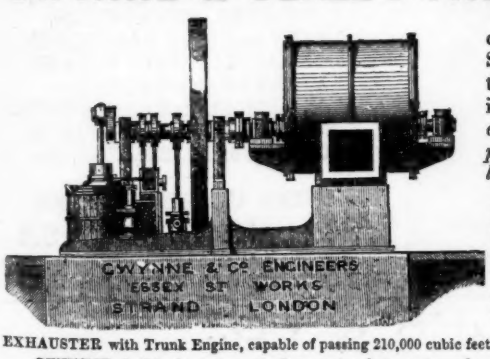
(Corrected by Mr. F. N. Golding, Sun Court, Cornhill, from the latest Stock Exchange Quotations.)

Number of Shares issued.	Amount per Share.	Name.	Amount paid up per Share.	Last Divd. p.Cent. p. Ann.	Latest Quotations.
	£	Gas Companies.	£ s. d	£ s. d	£
10000	20	Anglo-Romano . .	20 0 0	9 0 0	20—22
5000	20	Bahia (Limited). .	20 0 0	2 0 0	14—16
1000	20	Do., do., redeem.	20 0 0	2 0 0	25—27
1500	20	Do., 2nd pref. . .	20 0 0	7 10 0	21—22
40000	5	Bombay (Limited).	5 0 0	7 10 0	7¼—7¾
10000	5	Do., fourth issue.	4 0 0	7 0 0	5½—5¾
10000	20	British (Limited) .	20 0 0	10 0 0	41—43
7500	20	Cagliari (Limited).	20 0 0	5 0 0	16—17
550000*l.*	Sk.	*Commercial*	100 0 0	10 0 0	217—222
70000	100	Do., 7 per cent. .	..	..	150—155
20000	20	Continental Union.	20 0 0	6 0 0	22—23
10000	20	Do., new	12 10 0	6 0 0	1½—1¾pm.
10000	20	Do., preference .	20 0 0	7 0 0	26—28
75000	Sk.	*Crystal Palace District*	100 0 0	10 0 0	215—220
125000	Sk.	Do., 7 per cent. .	100 0 0	7 0 0	150—155
50000	Sk.	Do., preference .	100 0 0	6 0 0	135—140
23406	10	European (Limited)	10 0 0	10 0 0	18½—19½
12000	10	Do., new shares.	7 10 0	10 0 0	7—8pm.
35406	10	Do., new shares .	5 0 0	10 0 0	5½–5¾pm
3797770*l.*	Sk.	*Gaslight & Coke* A.	100 0 0	10 0 0	216—218
1000000*l.*	Sk.	Do. B.	100 0 0	4 0 0	85—90
30000	10	Do. 5 per ct. pref. conv., 3rd issue.	all	5 0 0	20¼—21
50000	10	Do. do., 4th do. .	6 0 0	5 0 0	9¼–9¾pm
50000	10	Do. do., 5th do. .	2 0 0	5 0 0	9–9¼ pm.
2000000*l.*	Sk.	Do. C 10 p.c. pref.	100 0 0	10 0 0	230—235
3000000*l.*	,,	Do. D do. do. .	100 0 0	10 0 0	230—235
1650000*l.*	,,	Do. E do. do. .	100 0 0	10 0 0	230—235
300000*l.*	,,	Do. F 5 do. do. .	100 0 0	5 0 0	114—116
600000*l.*	,,	Do. G 7½ do. do. .	100 0 0	7 10 0	165—170
1300000*l.*	,,	Do. H	100 0 0	7 0 0	153—156
6200	5	Georgetown, Guiana	5 0 0	5 0 0	..
15000	10	*Surrey Consumers.*	10 0 0	10 0 0	22—24
10000	10	Do., new	8 0 0	10 0 0	10–11pm
9000	4	United General . .	4 0 0	2 10 0	3—3⅛
1500	10	*Wandsw. & Putney*	10 0 0	10 0 0	19—20
1500	10	Do.	10 0 0	7 10 0	11—12
2957	10	Do.	10 0 0	7 0 0	..
993	10	Do.	3 0 0	7 0 0	..
16000	5	*West Ham*	5 0 0	10 0 0	8—8⅛
10000	5	Do., new shares .	2 10 0	10 0 0	3—4
		Malta and Mediterranean (Limited).	5 0 0	2 0 0	2½—3
		Do., preference .	5 0 0	7 10 0	5—5½
		Mauritius (Limited)	2 0 0	..	¼—1
		Monte Video (Lim.)	20 0 0	8 0 0	19—20
		Nictheroy, Brazil (Limited) . . .	10 0 0	3 10 0	..
		Oriental (Calcutta).	5 0 0	9 10 0	8¼—8⅜
		Do., new shares .	3 0 0	9 10 0	2½–2¾pm
		Ottoman (Limited).	5 0 0	3 0 0	2¼—3
		Pará (Limited) . .	10 0 0	7 0 0	5—5¼
		Phœnix	20 0 0	10 0 0	44—46
		Do., new	60 0 0	7 10 0	103—108
		Do., capitalized .	100 0 0	5 0 0	107—112
		Do., new, 1876. .	...	..	17–18pm
		Rio de Janeiro (L.)	20 0 0	10 0 0	34—36
		Singapore (Limited)	5 0 0	7 10 0	5½—5⅝
		Do., preference .	5 0 0	7 10 0	5⅞—6⅛
		Shanghai	32 10 0	12 0 0	30—32
		South Metropolitan	50 0 0	10 0 0	112—115
		Do.	12 10 0	10 0 0	28—29
		Do., new shares .	10 10 0	10 0 0	13—14 pm.
		Surrey Consumers.	10 0 0	10 0 0	22—24
		Do., new	8 0 0	10 0 0	10–11pm
12000	100	Chelsea	100 0 0	6 0 0	155—158
1800000	100	East London . . .	100 0 0	6 0 0	165—168
8000	50	Grand Junction . .	50 0 0	5 0 0	78—82
5840	25	Do., ½ shares . .	25 0 0	5 0 0	39—40
2160	25	Do., new ditto; max. div., 7½ p.c.	25 0 0	5 0 0	32—34
547960	100	Kent	100 0 0	8 0 0	190—195
970	100	Lambeth	100 0 0	6 5 0	156—159
1161	100	Do., max., 7½ p.c.	100 0 0	6 5 0	152—155
442	100	New River	100 0 0	7 0 0	270—300
4475	100	Do.	60 0 0	7 0 0	..
400000	100	Do., deb. sk., 4 p.c.	100 0 0	4 0 0	101—103
3036	100	Southwrk. & Vauxh.	100 0 0	4 0 0	116—119
1296	100	Do., pref. stock .	100 0 0	5 0 0	115—118
	100	Do., D shares . .	100 0 0	4 0 0	114—116
	..	Do., 4½ preference	100 0 0	4 10 0	106—108
	100	Do., new ordinary	..	4 10 0	..
1600	100	Do., new ord. No. 1	40 0 0	4 10 0	106—108
12172	61	West Middlesex . .	61 0 0	6*l.* p.sh.	145—147

* ex new

The GRAND MEDAL of MERIT at the VIENNA EXHIBITION, and TWO MEDALS at the PHILADELPHIA EXHIBITION, have been AWARDED to GWYNNE & CO. for GAS-EXHAUSTERS, ENGINES, and PUMPS; Also 27 OTHER MEDALS AWARDED at all the GREAT INTERNATIONAL EXHIBITIONS.

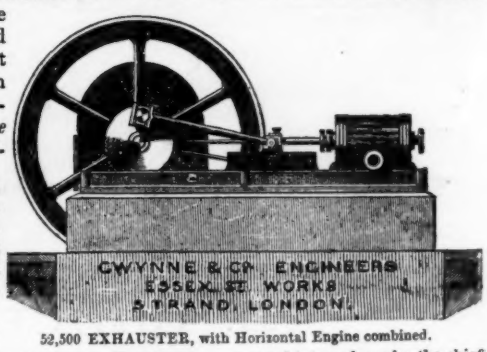
GWYNNE & BEALE'S PATENT GAS-EXHAUSTERS & ENGINES.



EXHAUSTER with Trunk Engine, capable of passing 210,000 cubic feet per hour.

The Judges report on the combined Exhauster and Steam-Engine exhibited at the Philadelphia Exhibition is—"*Reliable compact Machine, well adapted for the purpose intended, of excellent workmanship.*"

GWYNNE & CO. have made the largest and most perfect Gas-Exhausting Machinery in the world, and have completed Exhausters to the extent of 7,000,000 cubic feet passed per hour, of all sizes from 2000 to 210,000 cubic feet per hour.



52,500 EXHAUSTER, with Horizontal Engine combined.

GWYNNE & CO. do not pretend to enter into a struggle with other makers in respect to cheapness. They have never sought to make price the chief consideration, *but to produce machinery of the very highest quality, and most approved design and workmanship.* The result is that in every instance their work is giving the fullest satisfaction. Numerous testimonials and references can be given to Companies using their Machinery for years past.

Exhausters, with or without Engines combined, can be made to pass the gas without oscillation or variation in pressure. Regulators, Bye-Passes, Stop-Valves, Gas-Valves, Station Governors, and Gas Machinery of all Sizes.

PLEASE ADDRESS IN FULL, GWYNNE & CO., Hydraulic and Gas Engineers, ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON, W.C., ENGLAND.

☞ *G. & Co. are now making 6 Sets Exhausters and Engines for 105,000 cubic feet per hour, 3 Sets 180,000 Exhausters and Engines, with many others of all Sizes.*

WANTED, a steady single Man, as STOKER, by the SPILSBY GAS COMPANY.

WANTED, by a respectable Married MAN, aged 35, a situation as STOKER in a small country gas-works; 15 years testimonials.
Address X. Y. Z., 142, Columbia Road, Hackney Road, LONDON, E.

WANTED, by a Lancashire Manufac- turing Chemist, large or small quantities of strong Gas AMMONIACAL LIQUOR, above 8° Twaddel.
Address No. 353, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by a respectable Young MAN, aged 20, a situation as CLERK and COLLECTOR in a Gas-Work where opportunity is afforded to learn the main-laying and gas-fitting. Four years good reference.
Address P., Gas-Works, Builth, BRECON.

WANTED, a situation as a Working MANAGER in a small Gas-Work. Well up in manufacturing and purifying gas. Can do all main and service laying, and all fittings in works and out.
Address No. 355, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED immediately, an efficient FOREMAN for a small Gas-Work, to lay mains and services, and to do repairs on works, and competent to take charge of the works in the absence of the Manager.
Apply, with testimonials, and stating wages, to Mr. G. SMEDLEY, Gas-Works, BUXTON.

WANTED directly, two good steady MEN, as STOKERS, used to scoop, and able to control other men working under them. Wages 38s. per week. None need apply who cannot be well recommended.
Address No. 356, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

METER REPAIRER.

WANTED, at the Reading Gas-Works, a steady and experienced METER REPAIRER. Used to both Wet and Dry Meters. The situation is a permanent one.
Apply, stating age, experience, and wages required, to Mr. E. BAKER, Engineer.

SMALL Gas-Works wanted, to Purchase or RENT, within 20 miles of London.
Address, with full particulars, "GAS," care of Ashurst, Morris, and Co., 6, Old Jewry, LONDON, E.C.

TO BE LET or SOLD, a Property in the vicinity of London, admirably adapted for the erection of Water-Works, having an abundant supply of the purest spring water from the chalk.
For further particulars, apply to DRIVER AND HAYWOOD, 5, Victoria Street, WESTMINSTER, S.W.

TO BE SOLD, Four Cast-Iron Purifiers, 6 ft. square, with hydraulic centre-valve; also Ten 18-in. round, and Sixty-two 15-in. round Retort Mouthpieces, and Forty-seven 6-in. H-Pipes.
Apply to W. WINSTANLEY, Manager, Gas-Works, NEWCASTLE-UNDER-LYME.

TO GAS COMPANIES, CORPORATIONS, &c.

THE Advertiser (age under 40) has had nearly 20 years experience as ASSISTANT-ENGINEER of one of the largest gas establishments on the Continent, and is thoroughly acquainted with the construction and working of all the apparatuses connected with the manufacture, distribution, and analysis of gas; speaks and writes English, French, and German, and is at present resident engineer on Gas-Works of 300 to 400 million cubic feet working capacity (on the Continent). He is desirous to find a more remunerative, and equally permanent, APPOINTMENT than the one he now holds, and is in a position to offer first-rate references.
Address K. F. 4613, care of Messrs. Haasenstein and Vogler, Hamburg, GERMANY.

WALTON-ON-THAMES AND WEYBRIDGE GAS COMPANY.

FOR SALE, Three Engines and Ex- hausters (Two by Gwynne, and one by Waller) for 15,000 feet per hour. Being about to be replaced by larger ones.
Can be seen at the Works, Walton-on-Thames, or particulars can be had of Mr. GEORGE ANDERSON, 35A, Great George Street, WESTMINSTER.

GASHOLDERS.

FOR SALE, Two Telescopic Gasholders. One 50 ft. by 16 ft., the other 70 ft. by 20 ft., each complete, with cast-iron tanks, columns, girders, and inlet and outlet pipes, valves, &c., both of modern construction, in good condition, and made by Messrs. Piggott and Co., of Birmingham. To be seen at work at the Gas-Works, Birkenhead. Cause of removal to make room for extensions.
To be sold a bargain, taken down and re-erected ready for work.
For particulars apply to ASHMORE AND WHILE, Stockton-on-Tees; or to view, apply to Mr. CALLOW, Gas Engineer, BIRKENHEAD.

FOR SALE, Two Telescope Gasholders. One 52 ft. diameter by 22 ft., the other 52 ft. diameter by 28 ft., and one Single-Lift GASHOLDER, 50 ft. diameter by 14 ft., each complete, with columns, girders, inlet and outlet pipes, valves, &c.
Also Two 7-in. Parkinson's GOVERNORS.
May be seen, and further particulars obtained, on application to Mr. C. Hunt, Engineer, Gas-Works, Windsor Street, Birmingham.
Tenders will be received not later than the 31st inst., to be addressed to the CHAIRMAN of the Works Sub-Committee, Gas Offices, Old Square, BIRMINGHAM.
Birmingham, April 3, 1877.

THE Swansea Gaslight Company have for immediate SALE, the following Plant:—
A 6-h.p. Patent Trunk Engine. (Beale.)
Exhauster to pass 15,000 feet per hour. (Beale.)
An 8-h.p. Grasshopper Engine. (Easton and Amos.)
Exhauster, 20,000 ft. per hour. (Beale.)
Tar, Liquor, and Water Pumps, Eccentrics, Shafting, and Driving Pulleys.
Wrought-iron Condenser, six vertical Legs, 30 ft. high, 24 in. by 6 in., with tar-boxes, dips, and syphons.
A set of four cast-iron Purifiers, 12 ft. square by 5 ft. deep, with galvanized wrought-iron covers, lifting apparatus, four tiers of wooden sieves, 10-in. connexions and valves.
May be seen at the Gas-Works, Swansea. The whole in perfect working order; replaced by plant of larger dimensions.
Further particulars may be obtained on application to Mr. THORNTON ANDREWS, SWANSEA.

READING GAS COMPANY.

FOR SALE, as they now stand, and at any reasonable price, as the ground upon which they stand is wanted, four 12-ft.-square Cast-Iron PURIFIERS, with centre-valve and connexions, grids, tee bars, &c., complete.
Apply to Mr. E. BAKER, Engineer, Gas-Works, READING

THE Blackburn Gaslight and Coke Com- pany have FOR SALE one 25,000 feet per hour EXHAUSTER and ENGINE combined, with one 10-horse power BOILER. The Exhauster is by Musgrave and Co., of Bolton, and is only to be sold as it has been replaced by a larger one. Also four Wrought-Iron GIRDERS, 32 ft. long, 18 in. deep, 17 in. wide, double plated, at top, bottom, and web, with ½-in. plates.
Application for price, &c., to be made to the undersigned.
S. R. OGDEN, Engineer.

THE Kingston-upon-Thames Gas Com- pany have FOR SALE, cheap, second-hand PLANT as under:—
Two 12-ft. square PURIFIERS, with wrought-iron lids and lifting apparatus complete.
A quantity of 9-in. RACK-VALVES and connexions.
A Cornish BOILER, 4 ft. diameter by 10 ft. long, with safety-valves, furnace work, &c., complete.
A STATION-METER, made by Parkinson, to pass 20,000 feet per hour.
The whole of the above have been thrown out of use to make room for plant of larger dimensions.
H. F. PACKHAM, Engineer and Manager.

CANTERBURY GAS AND WATER COMPANY.

TO MANUFACTURING CHEMISTS.

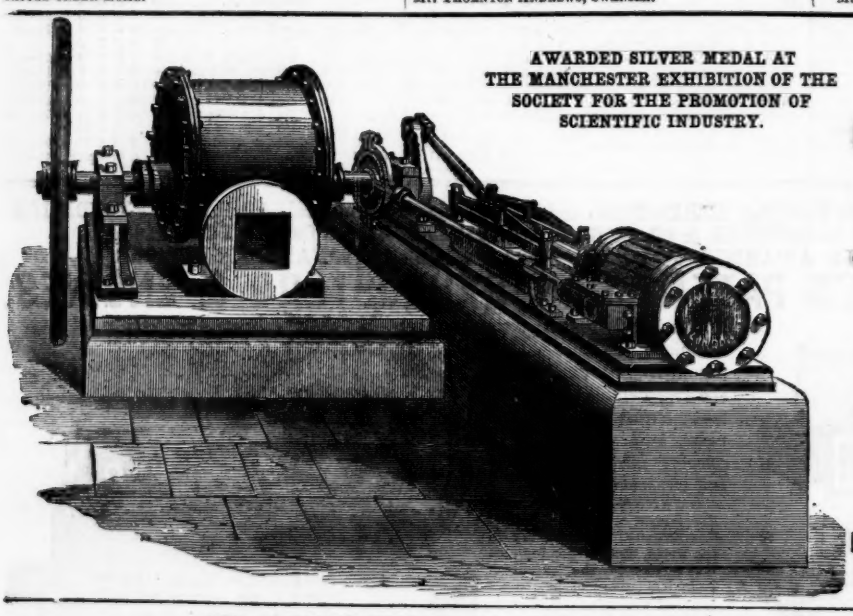
OFFERS are invited for about 100 Tons of SPENT OXIDE.
Samples will be sent on application to the Manager of the Gas-Works.
JAMES BURCH, Secretary.
March 26, 1877.

TO COAL MERCHANTS.

THE Directors of the Horsham Gas Com- pany, Limited, in Sussex, invite TENDERS for a supply of COALS for One year commencing May 1, 1877.
The description to be either Pelaw, Pelton, or Holmside.
The quantity required will be about 150 tons per month, to be delivered as required at the Horsham Railway Station, carriage paid.
The coals delivered in each month to be paid for by cheques drawn on the second Monday of the following month.
Sealed tenders, endorsed "Tender for Coals," to be sent to the undersigned on or before Saturday, April 7.
ROBT. SHEPPARD, Secretary.

TO MANUFACTURING CHEMISTS.

THE Macclesfield Corporation Gas Com- mittee are prepared to receive TENDERS for the purchase of the TAR and AMMONIACAL LIQUOR made at their Gas-Works for a period of One, Two, or Three years, dating from May 1, 1877, at the option of the Committee.
Sealed tenders to be delivered at the Town-Hall, Macclesfield, not later than Saturday, April 21, 1877, endorsed "Tender for Tar and Ammoniacal Liquor," and addressed to the CHAIRMAN of the Gas Committee, Town-Hall, Macclesfield.
The Committee do not bind themselves to accept the highest or any tender.
March 27, 1877.



AWARDED SILVER MEDAL AT THE MANCHESTER EXHIBITION OF THE SOCIETY FOR THE PROMOTION OF SCIENTIFIC INDUSTRY.

BEALE'S
Improved Patent
GAS-EXHAUSTERS
WITH
ENGINES COMBINED.
Sole Makers,
GEORGE WALLER & CO.

Makers of
ENGINES, EXHAUSTERS,
INDEX and DISC GAS-VALVES,
HYDRAULIC MAIN VALVES,
BYE-PASS VALVES,
TAR, LIQUOR, and other PUMPS,
SCRUBBERS and PURIFIERS,
CONDENSERS, BOILERS, &c.

PHŒNIX ENGINEERING WORKS,
HOLLAND STREET, S.E.,
AND
STROUD, GLOUCESTERSHIRE.

D. BRUCE PEEBLES & CO.,
ENGINEERS,
FOUNTAINBRIDGE WORKS, EDINBURGH,
MANUFACTURERS OF **WET AND DRY GAS-METERS;**
Patentees and Sole Manufacturers of "PEEBLES' GAS-GOVERNORS,"
FOR STATIONS, DISTRICTS, DWELLING-HOUSES, AND PUBLIC LAMPS,
OF WHICH UPWARDS OF 90,000 ARE NOW IN SUCCESSFUL USE.
"These Lamp-Governors are so superior that they are likely to supplant all others."—*Dr. Wm. Wallace, F.R.S.E., F.C.S.*

Now ready, price One Shilling, No. 5 (to be continued Monthly) of

A TREATISE ON THE SCIENCE & PRACTICE

OF THE

Manufacture and Distribution

OF

COAL GAS.

LONDON: WILLIAM B. KING, 11, BOLT COURT, FLEET STREET,

OR OF ANY BOOKSELLER IN TOWN OR COUNTRY.

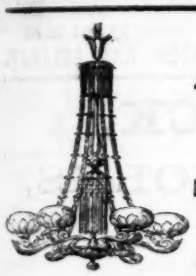
For the convenience of persons resident in remote districts, arrangements have been made by the Publisher to forward the "Treatise" by Post, securely packed on a roller, at the cost of the number and postage only—viz., 1s. 2d. Monthly, or 7s. for the Half Year.

JOHN HALL AND CO., STOURBRIDGE,

Manufacturers of FIRE-BRICKS, LUMPS, TILES,

AND EVERY DESCRIPTION OF FIRE-CLAY GOODS.

N.B.—A Stock of 15 and 16 in. CIRCULAR RETORTS always on hand. Other kinds made to order on short Notice.



F. & C. OSLER,

45, OXFORD STREET, LONDON, W.

MANUFACTORY AND SHOW-ROOMS:

BROAD STREET, BIRMINGHAM.

ESTABLISHED 1807.

MANUFACTURERS OF CRYSTAL GLASS CHANDELIERS,

WALL LIGHTS, AND LUSTRES FOR GAS AND CANDLES.

TABLE GLASS OF ALL KINDS.

CHANDELIERS IN BRONZE AND ORMOLU. MODERATOR LAMPS.

THE THAMES BANK IRON COMPANY,

(Successors to LYNCH WHITE,)

SUPPLY FROM STOCK

CAST-IRON RETORTS, SOCKET-PIPES for GAS or WATER PURPOSES, FLANGE-PIPES for STEAM, RAIN-WATER PIPES and GUTTERS, HOT-WATER PIPES and BOILERS, and all requisite Connexions for same; also LAMP-COLUMNS, LAMPS, WROUGHT FRAMES, WROUGHT-IRON TUBING, &c., &c.

All kinds of Gas-Works Apparatus and General Castings made to Pattern or Drawing.

ADDRESS—

OLD BARGE WHARF, UPPER GROUND STREET, LONDON, S.E.

GAS PURIFICATION.

BAILES & HALLSWORTH,

CONTRACTORS FOR THE

PURIFICATION OF COAL GAS,

BY THEIR

PATENT OXIDE OF IRON COMPOUND.

The material is in use at most of the principal Gas-Works in Yorkshire and elsewhere. It contains considerably less moisture than natural Oxide of Iron. It is much cheaper and more efficient as a purifying agent.

B. & H. are purchasers of Spent Oxide, or will take Spent in exchange for New Material.

FOR SAMPLES AND TERMS, ADDRESS—

BAILES & HALLSWORTH, COPPERAS WORKS, ARMLEY, LEEDS.

E. J. & J. PEARSON,

DELPH AND TINTAM ABBEY FIRE-BRICK WORKS,

STOURBRIDGE,

MANUFACTURERS OF

FIRE-CLAY RETORTS

And all descriptions of FIRE-BRICKS.

PRICES ON APPLICATION.

TOTTENHAM AND EDMONTON GAS-LIGHT AND COKE COMPANY.

NOTICE is hereby given that a GENERAL MEETING of SHAREHOLDERS will be held at the Works, Willoughby Lane, Tottenham, on SATURDAY, the 14th day of April next, at Three o'clock in the afternoon precisely, to receive the Report of the Directors, and to declare an interim dividend.

The Transfer Books of the Company will be closed from the 29th of March to the 14th of April inclusive.

By order of the Board,

JAMES RANDALL, Secretary.

Edmonton, March 29, 1877.

*** Train leaves Liverpool Street Station, G.E.R., 2.0 p.m., due at Park Station 2.22.

PAMPHLET ON GAS.

COOKING AND HEATING.

HINTS ON GAS-BURNERS, &c.

For GAS COMPANIES to distribute to their Gas Consumers.

Specimen Copy by post Threepence, from the Author,

MAGNUS OHREN, Gas-Works, Sydenham, S.E.

TO CONTRACTORS.

THE Kidsgrove Gaslight Company invite

TENDERS for making a GAS-TANK about 30 feet wide.

Plans and specifications may be seen on application to the Manager, at the works.

Sealed tenders to be sent to the Secretary not later than the 12th of April.

The Directors do not bind themselves to accept the lowest or any tender.

T. WARDLE, Secretary.

March 29, 1877.

TO GASHOLDER MAKERS.

THE Kidsgrove Gaslight Company intend

either to erect a new GASHOLDER, or to TELESCOPE an old one. The Directors invite TENDERS for each.

Plans and specifications may be inspected on application to the Manager, at the works.

Sealed tenders to be sent to the Secretary not later than the 12th of April.

The Directors do not bind themselves to accept the lowest or any tender.

T. WARDLE, Secretary.

March 29, 1877.

AMMONIACAL LIQUOR.

THE Directors of the Maidenhead Gas

Company are prepared to receive TENDERS for the purchase of the AMMONIACAL LIQUOR made at their works alongside the Thames at Taplow.

Tenders will be received on or before Monday, April 16, and may be for One, Two, or Three years.

The Liquor will be pumped into barges in the river.

For further particulars apply to the SECRETARY, Gas Company, MAIDENHEAD.

The Directors are not bound to accept the highest or any tender.

FRAMLINGHAM GASLIGHT COMPANY, SUFFOLK.

THE Directors of the above Company

are prepared to receive TENDERS for alterations at the Gas-Works:—

A new Hydraulic Main, Condensers, Purifiers, Gasholder, &c., and a quantity of new Mains.

Plans and specifications may be seen at the Secretary's, or copies of the same will be sent on receipt of P.O.O. for 7s. 6d., payable to Joseph Barker, jun.

Sealed tenders to be sent to the Secretary on or before the 25th of April next.

By order,

JOSEPH BARKER, jun., Secretary.

Bridge Street, Framlingham, March 24, 1877.

TO GASHOLDER MAKERS.

THE Stretford Gas Company invite

TENDERS for the supply and erection at the Gas-Works, Stretford, One TELESCOPIC GASHOLDER, 100 ft. in diameter with inlet and outlet pipes, valves, &c., in accordance with drawings, specifications, and conditions, which may be seen at the Gas-Works, on and after Monday, the 2nd of April.

The Company do not bind themselves to accept the lowest or any tender.

Sealed tenders, endorsed "Tender for Gasholder," to be sent in not later than the 16th of April, and addressed to the CHAIRMAN, Gas-Works, STRETFORD.

BENJ. HAYNES, Secretary.

Stretford, near Manchester, March 21, 1877.

HONITON GAS AND COKE COMPANY.

TENDERS are invited for a Lease of the

works of the above Company, situate at Honiton, in the county of Devon.

Quantity of gas made last year, as returned by the present lessee, 4,000,000 cubic feet.

The term of the Lease will be for Ten years, from Midsummer, 1877.

Further particulars may be obtained on application to the Secretary.

A draft of the Lease may also be seen.

Sealed tenders to be addressed to the Secretary on or before May 1, 1877.

JOHN MUNCH, Secretary.

Honiton, March 22, 1877.

SOUTH SHIELDS GAS APPARATUS EXHIBITION,

AT THE

FREE LIBRARY HALL,

WILL BE OPEN TO THE PUBLIC

ON

MONDAY, TUESDAY, and WEDNESDAY, APRIL 9, 10, and 11, FREE,

(ON MONDAY BY TICKET ONLY,)

From Twelve to Four.

J. H. PENNEY, Secretary.

Gas Company's Offices.

BELFAST CORPORATION GAS-WORKS.

THE Gas Committee of the Belfast Town Council invite ESTIMATES for the taking down and rebuilding of a Bench of RETORTS, containing 12 arches (single retorts). The work will include resetting of retorts.

Estimates must be received on or prior to April 16, 1877.

Full particulars may be obtained on application to

JAMES STELFOX, Engineer and Manager.

TO GASHOLDER MAKERS.

THE Gas Committee of the Darlington Corporation invite TENDERS for the re-sheeting of a Single-Lift GASHOLDER, 80 ft. diameter and 20 ft. deep, with channel guides for tank and tripods; also bottom and top carriages, with rollers.

Specifications and other particulars may be obtained on application to Wm. Smith, the Engineer.

Tenders, endorsed "Tender for Holder," to be sent to me not later than April 18, 1877.

The Committee do not bind themselves to accept the lowest or any tender.

WM. SMITH, Engineer.

Darlington Gas-Works, March 30, 1877.

MANCHESTER CORPORATION GAS-WORKS.

TO COLLIERY PROPRIETORS AND OTHERS.

THE Gas Committee are prepared to receive TENDERS of CANNEL and COAL, for delivery at their works, situated at Gaythorn and Rochdale Road.

Sealed tenders, for One or more years, stating price and quantity proposed to be delivered at each station, the rate and period of delivery, and endorsed "Tender for Cannel," or "Coal," as the case may be, must be addressed to the Chairman of the Gas Committee, and delivered at this Office on or before Wednesday, April 11, 1877.

The Committee do not bind themselves to accept the lowest or any tender.

By order,

JOSEPH HERON, Town-Clerk.

Gas Office, Town-Hall, Manchester,
March 26, 1877.

WIDNES GAS-WORKS.

THE Widnes Local Board invite separate TENDERS for the construction of a RETORT-HOUSE as under:—1. For the Excavation, Brickwork, Masonry, &c., for Building and Retort Benches. 2. For the Ironwork, consisting of Roofing, Hydraulic Mains, Mouthpieces, Columns, Pipes, &c.

Plans and specifications can be seen at the Engineer's Office, Gas-Works, Widnes, and bills of quantities obtained on payment of one guinea, which will be returned on receipt of a *bonâ fide* tender.

Tenders, endorsed "Ironwork," or "Building," as the case may be, and addressed to the Chairman of the Gas and Water Committee, to be delivered at the above works before Ten a.m. upon the 26th of April.

The Board do not bind themselves to accept the lowest or any tender.

HENRY ROBERTS.

Widnes, March 24, 1877.

FIRE-CLAY WORKS FOR SALE.

TO BE SOLD by PUBLIC ROUP, within the Town-House, Inverkeithing, on THURSDAY, April 19, 1877, at Two p.m., the INVERKEITHING FIRE-CLAY WORKS, near to the Town of Inverkeithing, as the same have been carried on for many years by the late Mr. Fraser, together with the goodwill of the business.

The works adjoin the Great North Road. The Dunfermline and Queensferry Railway passes within a few yards, and a connexion can easily be formed. The Halbeath and Inverkeithing Railway intersects the works, and affords direct communication to the coal-fields and Inverkeithing Harbour, which are at a short distance.

Fire-clay abounds in the neighbourhood.

The works and their connexions occupy about Two acres, and are in all respects complete. They include a serviceable engine of 12-horse power. There is also an excellent Manager's house.

A large business has been carried on in these works for about 50 years, and they have attained a high reputation, more especially for gas-retorts, for which orders are received from all parts of the world, and largely from London.

The whole plant and stock-in-trade will be made over to the purchaser at a valuation. Entry on the 1st of May.

Upset price, £2000; Feu-duty, £2 15s.

For further particulars apply to JOHN ROSS, Writer, DUNFERMLINE.

TO INVENTORS AND PATENTEES.

MR. W. H. BENNETT, having had considerable experience in matters connected with Gas, Water, and Sanitary Improvement, begs to say that he continues to assist Inventors in the perfection of their designs, and to obtain for them PROVISIONAL PROTECTION, whereby their invention may be secured for Six Months; or LETTERS PATENT, which are granted for Fourteen Years.

Patents completed, or proceeded with at any stage, thereby rendering it unnecessary for persons resident in the country to visit London.

Patents procured for Foreign Countries.

Information as to cost, &c., supplied gratuitously upon application to the Advertiser, 22, Great George Street, WESTMINSTER.

NOW READY,

THE

GAS COMPANIES EXPENDITURE JOURNAL,

Being a Ruled Account-Book with Printed Headings, and Analyzing Guide for Keeping, upon the easiest and most correct method, the Expenditure of a Gas Company, in accordance with the provisions of the Gas-Works Clauses Act of 1871, and suitable for all Companies.

Prices, half bound, cloth sides, 2 quires, 30s.; 3 quires, 36s.; other sizes and bindings to order.

Published by EDWARD SANDELL, Accountant, 4, Skinner's Place, Size Lane, QUEEN VICTORIA STREET, and W. B. KING, Office of the JOURNAL OF GAS LIGHTING, 11, Bolt Court, FLEET STREET, E.C.

J. EDMUNDSON & CO.,

19, GREAT GEORGE STREET, WESTMINSTER, LONDON, S.W.,

MANUFACTURERS OF EVERY DESCRIPTION OF

GAS APPARATUS.

CONTRACTORS FOR THE

ERECTION OF GAS-WORKS, GAS-FITTINGS, &c.,

FOR TOWNS, COUNTRY MANSIONS, &c.

Estimates given free of Charge.

Now Publishing, will be ready the first week in April,

THE GAS & WATER COMPANIES DIRECTORY FOR THE YEAR 1877,

EDITED BY

CHARLES W. HASTINGS,

8, BUCKINGHAM STREET, ADELPHI, LONDON, W.C.,

CONTAINS

An Alphabetical List of Towns in England having Gas or Water Companies.
Date of Formation of the Company.
If Incorporated under Special Act of Parliament, and the date of such Act or Acts.
If under any of the Limited Liability Acts.
Amount of Share Capital.
Name of Chairman.
Name of Engineer or Manager.
Name of Secretary.
If Let on Lease, Name of Lessee.
If a Private Venture, Name of Owner
If Purchased by the Corporation (and in cases where possible the date of such Purchase), or if the Property of the Local Authorities.
Population of all Towns.
Railway Communication, and the Distance from London.
Special Notice is taken of all the Members of the "British Association of Gas Managers."

THIS WORK IS UNDER THE PATRONAGE OF ALL THE LEADING GAS & WATER ENGINEERS AND SECRETARIES OF THE METROPOLITAN & PROVINCIAL COMPANIES.

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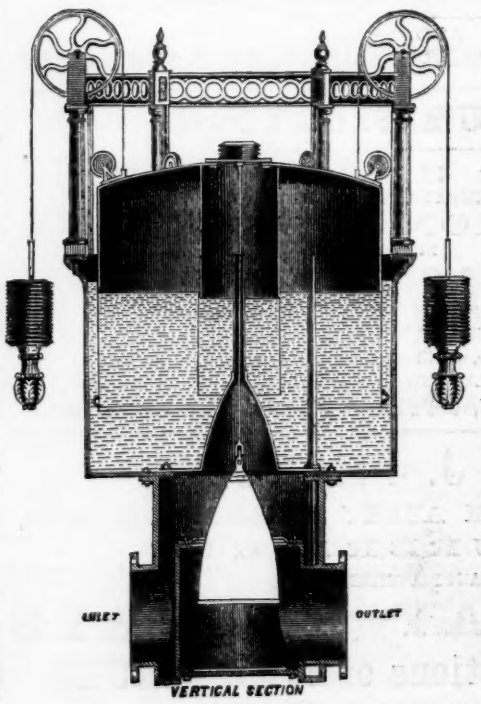

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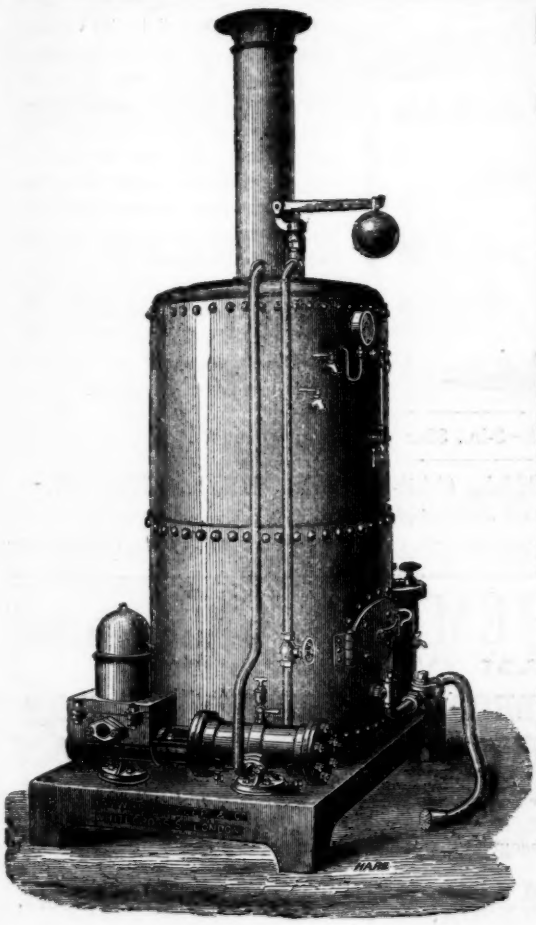

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THE Gas Committee of the Corporation of Carnarvon invite TENDERS, with plans and specifications, for the supply and erection of a Single-Lift GASHOLDER of 80,000 cubic feet capacity.

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MASKELL WM. PEACE, Town-Clerk.

Wigan, March 23, 1877.

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THE Directors of the Borough of Portsmouth Water-Works Company are prepared to receive sealed TENDERS for the laying and jointing of about 20,000 yards of 12-in. and other PIPES, and sundry work in connexion therewith, from the Company's high level reservoirs on Portsdown Hill, to the town of Portsmouth.

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The tenders to be addressed to the Directors, under cover to the Secretary, and marked "Tender for Pipe-Laying."

Parties tendering will be required to send with their tenders a statement or certificate of their having executed work of a similar character satisfactorily. Bond or security to the amount of £1000 will be required.

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By order,
R. W. FORD, Secretary to the Company.

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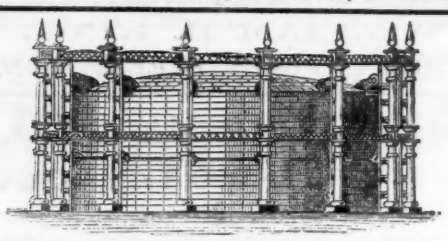

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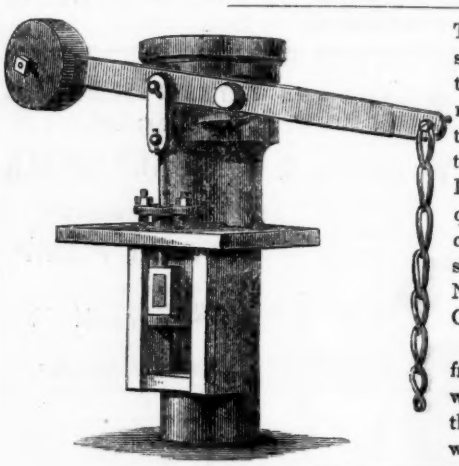

The advantages of this Dip will be seen from the engraving. It is thoroughly effectual in its working, removing the whole of the pressure of the hydraulic main from the retort, thus causing a great saving in gas. It is very easy of manipulation, requiring little care and attention; it cannot get out of order, and, when shut, works as an ordinary Dip-Pipe. No accumulation of carbon in retort. Can be fixed to existing H-pipes.

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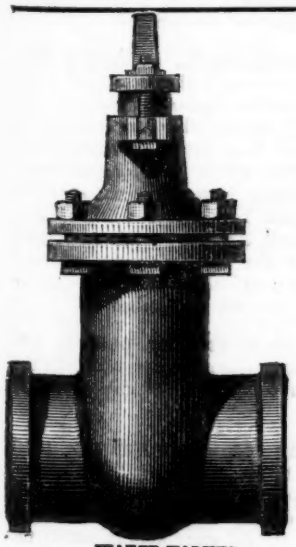

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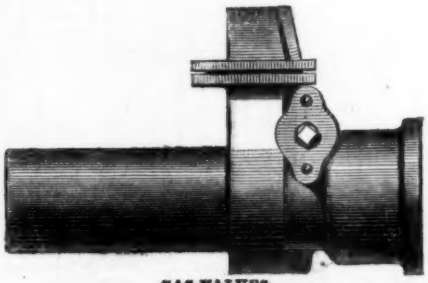

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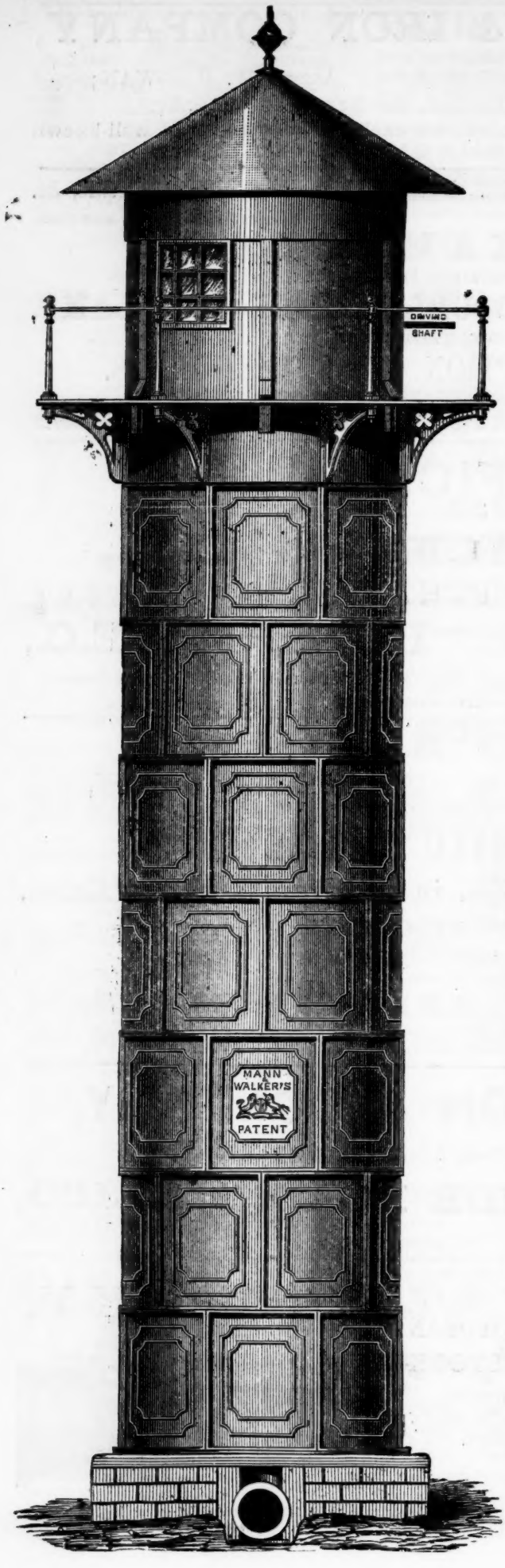

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By their use the department of purification from ammonia upon a gas-works is made complete, without the aid of prepared oxide of iron, chemicals in purifiers, or any other supplementary process, and the whole ammoniacal residual product contained in the coal is absorbed and obtained in the form most profitable to a gas company, while the requirements of all Acts of Parliament and of the Board of Trade, relating to incorporate gas companies, are satisfied.

Foul Gas, properly condensed, entering the inlet is, by once only passing through the Scrubber, completely purified from ammonia with regular certainty day by day, without any further trouble, or any other process, effected by a very small quantity of clear water let into the machinery room at the top of the Scrubber, which is discharged at the liquor outlet at the bottom, from Newcastle coal at about 18 to 20 ounces strength, from Yorkshire and other coals, generally from 25 to 30 ounces strength; while acidulated litmus or turmeric exposed at the Scrubber outlet will not show the slightest discoloration, and there is not a quarter of a grain of ammonia per 100 feet left unabsorbed.

They contain their own engine power, requiring only a small inappreciable quantity of steam from the gas-works boiler, and are then complete in themselves, ready for service.

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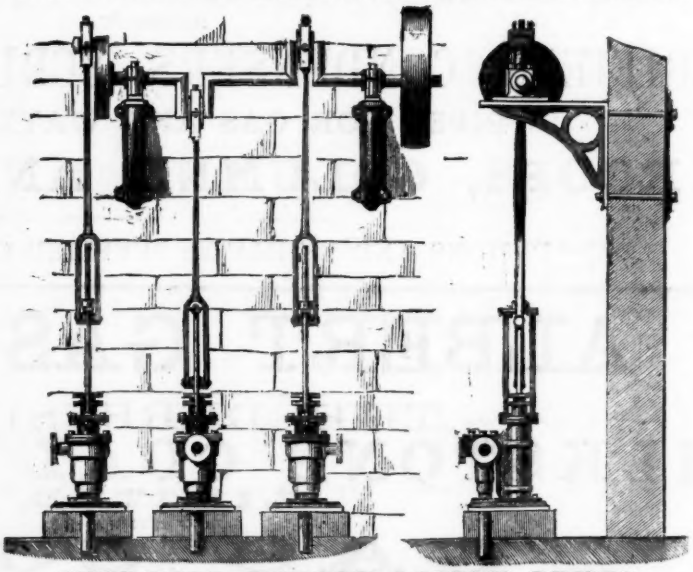

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